The
Southern Surgeon

Subscription in the United States, $4.00

Vol. VII, No. 2 Copyright 1938 by
The Southern Surgeon Publishing Co. April, 1938

SCIATICA AND LOW BACK PAIN

A Study of Thirty-one Consecutive Cases in Which Twenty-Four Were Due to a Displaced Intervertebral Cartilage

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SCIATICA should be considered as a symptom syndrome and not as a diagnostic entity. The treatment of this painful condition has long been a problem. Until recently the cause has been determined in only a small percentage of cases. Tumors of the cauda equina, pelvic diseases affecting the lumbosacral plexus, and lesions showing marked bony changes in the x-ray films were diagnosed, but there remained a very high percentage of sciatic cases in which no cause for the pain could be established. These cases were categorically classified as "sciaticas," and as many types of treatments were employed as there were ideas about the cause of the pain. Foci of infection, congenital anomalies of the lumbosacral region, and "sacroiliac disease" have in turn been offered as a cause of low back pain. These seldom have been supported by a definite pathologic or physiologic rationale. Many types of treatment have been advocated for sciatica. While some forms of treatment have been encouraging the results have not been uniformly good. Albee[1] in 1909 suggested disease of the sacro-iliac joint as a possible cause of many obscure and unexplained backaches and persistent sciaticas. In 1927 Albee[2] revised his views and attributed 90 per cent of low back pain, "lumbago," "sacroiliac strain" and "sciatica" to toxic absorption of the colon. He coined the term "myofascitis" for these conditions and advocated colonic irrigations. In 1926 Smith-Petersen[3] reported twenty-six cases of "sciatica" treated by sacro-iliac fusion. As an end result he reported that twenty-two of these pa-

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tients completely recovered, two patients partially recovered, and two cases were reported as failures. The average time of return to light activities was 2.6 months and to full activities 4.5 months in these patients. Hibbs[4] in 1929 reported 147 patients with low back pain and disability: 54 per cent of these patients had radiation of the pain into the hip or down the thigh or leg. He ascribed the disability to a mechanical defect at the lumbosacral juncture, the result of an anatomic variation. All of these patients were treated by lumbosacral fusion. The patients were kept recumbent six to eight weeks after operation and wore a brace from three to twelve months. He reports 73.3 per cent entirely relieved and 14 per cent improved. Brahme[5] in 1934 reported fifteen cases of sciatica who were all improved after tonsillectomy. Haguenau[6] in 1934 among other therapeutic suggestions mentioned the injection of 10 cubic centimeters of lipiodol in the region of the sciatic nerve. In 1935 Ober[7] reported five cases of "sciatica" treated by section of the tensor fascia lata. The relief was not always immediate but the end results were encouraging. Freiberg[8] in 1937 advocated section of the pyriformis muscle or section of the iliotibial band (Ober's operation) in certain selected cases of low back pain. These numerous therapeutic contributions have netted relief in a variable percentage of cases in the treatment of certain cases of low back pain and sciatica. The majority of these procedures as have been advocated are mostly empirical efforts and are feebly grounded physiologically.

More recently it has been demonstrated that in a large number of cases of "sciatica" the pain is due to compression of spinal roots by the herniated portion of a ruptured intervertebral disc. This type of lesion was recognized as early as 1896 by Kocher[9] and there have been up until 1934 occasional similar case reports. In 1934 Mixter and Barr[10] reported nineteen cases and concluded that rupture of the intervertebral disc was not an uncommon cause of sciatic symptoms. They also pointed out that such a lesion had frequently been mistaken for a cartilaginous neoplasm arising from the intervertebral cartilage. Later in 1934 Mixter and Ayer[11] reported fifteen additional cases making a total of thirty-four cases. Hampton and Robinson[12] in 1936 reviewed fifty cases of Mixter's group from a roentgenographic aspect. Barr[13] in 1937 reviewed forty cases from the same group giving a detailed analysis of the diagnosis, treatment and end results. Love and Camp[14] in 1937 reported fifty cases from the Mayo Clinic. Of this group the lesion was located in the lumbar region in thirty-nine cases and caused low back pain and sciatica. In the remaining eleven cases the lesion was in the cervical or dorsal regions and gave rise to root pain and signs of spinal cord compression simulating spinal cord tumor.

In the cases of sciatica resulting from rupture of the intervertebral disc there is anatomic and pathologic proof of the lesion. The subjective and objective findings on clinical examination are physiologically consistent with the root compression shown at operation. Upon removal of the lesion this nerve root compression is released and the patients are relieved of their pain.

Fig. 1. Typical defect in lipiodol caused by herniation of the intervertebral disc below the fourth lumbar vertebra.

This report is based on an experience of thirty-one consecutive cases with sciatic pain in which lipiodol studies have been carried out. Of these patients twenty-four were shown to have a herniated intervertebral disc on fluoroscopic studies. While this series is too small to be of statistical value these findings suggest that the incidence of ruptured intervertebral disc as a cause of low back pain and sciatica is high.

The chief complaint in every case was pain. This was usually present in the low back region, radiating toward the hip, down the posterior aspect of the thigh, the lateral aspect of the leg, or the outer part of the foot depending on the spinal roots compressed. The lower lumbar roots innervate the anteromedial aspect of the

leg and foot. The upper sacral roots innervate the posterolateral aspect of the foot and leg, while the lower sacral roots innervate the posterior aspect of the thigh, buttock and perineum. For the detailed segmental skin distribution of the spinal nerve roots, any standard textbook of anatomy may be consulted. The distribution of pain in the "sciaticas" is indicative of the nerve roots which are compressed. Some of the patients had bilateral pain, though it was usually more severe on one side. The pain was exaggerated by any type of activity which involved motion or jarring of the spine. Patients commonly complained of pain on bending over to tie their shoes, climbing stairs or arising from a sitting position. Activities which raised the spinal fluid pressure such as coughing, sneezing or straining often increased the pain. In several patients the pain was so severe that they could no longer walk and even turning in bed was an ordeal for them. One patient had to be given a general anesthetic before he could be turned into position for a lumbar puncture. Subjective numbness was very commonly complained of, and, when present, was usually over the dorsum of the foot or the calf of the leg.

More than half of these patients associated their pain with a definite injury. Some of the others had had an injury before the onset of their pain but a definite causal relationship could not be established. Lifting a heavy object was often associated with onset of the pain. Landing in a sitting position upon falling was another common injury which precipitated "sciatica." Accidents which caused the spine to be sharply bent or twisted were described by some of the patients.

Careful neurologic examination revealed positive findings in a large percentage of the cases. The most common finding was a diminished or absent ankle-jerk although this reflex was occasionally hyperactive. The knee-jerks were sometimes diminished or exaggerated but were more often normal. Next in frequency on neurologic examination were sensory disturbances. Slight sensory diminution over the dorsum of the foot or the calf of the leg was the usual finding, although slight hypesthesia over the buttock or posterior aspect of the thigh was almost as commonly found. Sensory changes over any part of the lumbar or sacral segmental distribution were encountered depending on which spinal roots were compressed. Definite atrophy of the calf or thigh muscles was sometimes found. A few cases showed no definite neurologic signs even on repeated examinations.

The information obtained from lumbar puncture was of real value in most of the cases. The most valuable aid was the total protein determination of the spinal fluid. This was reported as over 40 mg. of total protein per 100 c.c. in over half of the cases. When the

total protein in the spinal fluid is elevated in a patient with sciatic pain, frank nerve root irritation is established. In one case the herniated disc completely blocked the canal as demonstrated by a failure of the spinal fluid pressure to rise during compression of the jugular veins.

Fig. 2. Lateral view of a lipiodol defect caused by a ruptured intervertebral disc.

X-rays of the lumbosacral spine often revealed important changes but did not always show any abnormality. In some cases a narrowing of an intervertebral space was seen. This finding was not accepted as conclusive evidence for it has also been seen in the examination of x-ray films taken for other studies. Many cases showed a loss of the normal lumbar lordosis. This is the so-called "poker-spine" and is the result of muscle spasm. This muscle spasm also resulted in a listing of the patient's posture which was sometimes towards and sometimes away from the side of the pain.

The diagnosis as well as accurate localization was proven in each case preoperatively by lipiodol studies. Lipiodol was injected into the subarachnoid space and its excursion along the canal was observed under the fluoroscope. The herniated portion of the disc caused an indenture in the dural canal which was seen as a defect in the lipiodol as it flowed past the lesion. At one time lipiodol was thought by some to be harmful and it was used sparingly. More

recently carefully controlled experimental work, in both laboratory animals and in patients, has been done which has shown lipiodol to be safe for intraspinal injection (Fraser and Glaser[15] and Globus[16]). Globus in a follow-up study of ninety patients who had had intraspinal lipiodol concluded that there were no neurologic residuals and that the oil did not become encapsulated. It is important to use lipiodol which is specially prepared for intraspinal injection or serious reactions are likely to occur. Observing such precaution there have occurred no reactions resulting from lipiodol in any of the thirty-one cases in this report.

Fig. 3. Diagrammatic sketch to show the relation of the protruding cartilage to the spinal roots. (Modified and redrawn from Love.)

The pathologic defect as visualized under the fluoroscope was sometimes rather small although persistent and with increased experience it was possible to establish a preoperative diagnosis. The operative exposure of the lesion did not in every instance conform in size to the lesion as depicted by the roentgenologic indenture of lipiodol. The anatomic defect was usually surprisingly large. The site of the defect was most commonly in the region of the intervertebral space below the fourth or fifth lumbar vertebra. A lesion at any level below the twelfth thoracic vertebra might give rise to sciatic pain. Ruptured discs above the twelfth thoracic level were rare and these did not give rise to sciatic pain but to pain in the distribution of the roots compressed.

The only treatment in the cases where the diagnosis was proven by lipiodol studies was operative removal of the herniated portion

of the disc. Often the lesion was removed through an approach where only a small portion of the laminal arch was removed. This allowed removal of the lesion without significant weakening of the spine. Such patients may be allowed out of bed as early as their wound healing permits. Two such patients were permitted out of bed by the end of their first postoperative week with no discomfort.

Fig. 4. X-ray picture of the lumbosacral region showing the small amount of bone removal necessary to allow removal of the herniated portion of the ruptured intervertebral disc.

In the cases where the dura was opened one or more roots could be seen to be distorted by the lesion (Fig. 3). These roots were not infrequently swollen, edematous and congested. In several patients who had had sciatic pain for a long time the nerve roots were bound together by adhesions as a result of the chronic compression. In one-half of the cases the sensory portion of the root which was most compressed was sectioned. This may have been an unnecessary precaution but it has been shown by Foerster[17] that section of a single nerve root does not leave any permanent sensory loss. Evaluation of sacrificing the compressed root can only be determined in a follow-up study, comparing such cases with those in which there was no section of the damaged sensory root.

The patients in whom a ruptured disc was demonstrated and removed were uniformly relieved of their sciatic pain at the time of operation. The following abstracts of two cases are representative of the cases in this communication, illustrating in brief the history, examination, laboratory studies and results:

Report of Cases

Case 1.—J. S., a white woman, aged 47 years, was admitted to Grady Hospital Dec. 27, 1937. In 1921, the steps on which she was standing collapsed and she fell through 4½ feet to the ground landing on her feet. In 1923 she began having pain in both hips and radiating down the left leg to the ankle and to a much less extent down the right leg. The pain had persisted constantly since 1923 as a chronic low back pain with radiation into the legs whenever she was active, particularly on stooping or lifting objects. On three occasions she had acute exacerbations of her pain which necessitated bed rest for several weeks each time, and during two of these acute exacerbations she insisted that she was "paralyzed" because of the severe pain.

She was unable to walk because of pain. Both ankle-jerks were absent and the left knee-jerk was greatly diminished. There was a sensory diminution in all of the sacral skin segments on the left side but more marked over the dorsum of the foot. There was no demonstrable muscle atrophy. Lumbar puncture was performed with great difficulty because of the lumbar muscle spasm. The total protein content in the spinal fluid was 28 mg. Lipiodol studies showed a shift of the terminal part of the arachnoidal sac of the canal to the right at a level of the first sacral segment.

Operation: The herniated portion of the intervertebral disc was removed from within the sacral canal. This removal was followed at once by relief of pain.

The patient was discharged and walked out of the hospital on the eleventh day after operation.

Case 2.—T. G., a colored man, aged 35 years, admitted to Grady Hospital Jan. 3, 1938. There was no history of injury. In April 1937 he began having pain in his right hip which extended down the back of the leg along the course of the sciatic nerve as far as the ankle. He had had at times some sensation of numbness in the right calf. He could walk but did so with a limp. Climbing stairs, stooping, lifting, sneezing and straining at stool caused his pain. The right ankle-jerk was less active than the left. No sensory disturbance could be demonstrated. There was no atrophy. The total protein content in the spinal fluid was 35 mg. Lipiodol studies showed a filling defect between the fifth lumbar and the first sacral vertebrae.

Operation: The herniated portion of the intervertebral disc was removed. There was immediate relief of pain and the patient was discharged home on the eighth day after operation.

Resume

In the past much confusion has existed as to the pathologic lesions causing low back pain and "sciatica." More recently it has been demonstrated that in a large number of cases of low back pain and sciatica, the pain is due to compression of spinal roots by the herniated portion of a ruptured intervertebral cartilage. Of thirty-one consecutive cases of low back pain and sciatica in which lipiodol studies have been carried out, twenty-four were shown to have a ruptured intervertebral cartilage. In each of these cases the lesion

was demonstrated on fluoroscopic lipiodol studies. Following the removal of the compressing disc the patients were consistently relieved of their sciatic pain. It can be only concluded that a ruptured intervertebral disc or a herniation of the nucleus pulposus is a common cause of low back pain and sciatica, and as such must be considered or excluded in the treatment of such cases.

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THE SURGICAL TREATMENT OF GENERAL PERITONITIS BY THE HANDLEY OPERATION

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THE most important death-producing factor in peritonitis is the mechanical effect of intestinal obstruction. The clinician is impressed with the repeated, effortless vomiting of large quantities of intestinal contents. The same mechanical conditions are observed in obstruction of the small intestine from volvulus or angulations as the result of postoperative adhesions. In the latter syndrome there is, in the initial stage, no temperature, relatively little increase in pulse frequency, slight distention and only occasionally pain, yet the patient regurgitates or vomits daily, quantities ranging from 300 or 400 c.c. to 1,000 c.c. of material from the small intestine. If to this picture is added the temperature and alert anxious expression—hippocratic facies—and the markedly accelerated pulse rate, you have the clinical presentation of acute generalized peritonitis. This characteristic, clinical syndrome in peritonitis is the result of two diverse physico-pathologic conditions: (1) the absorption of toxic by-products from the peritoneum, and (2) a rapid water and chemical imbalance from the fluid and chemical loss from the upper intestinal tract by regurgitation and vomiting.

The total surface area of the peritoneum is about equal to the skin area, between 17,000 and 18,000 square inches[1]. Absorption of fluids from the peritoneal cavity is accelerated by the Trendelenburg posture and minimized by the so-called Fowler posture, the rate of absorption being 15 per cent less when the head and body are elevated. The rate of absorption varies with the different portions of the peritoneal cavity. The most rapid absorption takes place from the diaphragm, secondly from the omentum, thirdly from the visceral peritoneum, fourthly from the parietal peritoneum, and least from the pelvis. Experimental and clinical data indicate that absorption is hemic, not lymphatic; that the peritoneum is capable of absorbing from 3 to 8 per cent of the body weight in one hour; that the rate of absorption is dependent upon position; that the localization of fluid within the peritoneal cavity modifies the rate of absorption; that the character of the fluid influences the rate of absorption; that respiratory and peristaltic activities increase ab-

Presented at the Postgraduate Surgical Assembly, the ninth annual meeting of The Southeastern Surgical Congress, Louisville, March 7, 8 and 9, 1938.

sorption; that all absorption depends upon the living integrity of the endothelium. Solid particles are engulfed by a variety of peritoneal cells, macrophages, microphages and the neutroleukocytes. The great majority of foreign particles are probably encapsulated by fibrinoplastic lymph.

The absorption of soluble toxins corresponds to the absorption of fluids. Buxton and Torrey[2] found that if a large dose of typhoid bacilli were injected into the peritoneal cavity of a rabbit the bacteria were immediately destroyed by bacteriolytic substances of the blood serum. The rapid bacteriolysis liberated a large amount of endotoxin and an overwhelming dose of toxin was absorbed, with death. This observation is paralleled in humans by the deaths that immediately follow extensive operative procedures in the presence of an active peritoneal infection where the manipulations and trauma incident to the operation bring about an initial lethal dose of toxin. The mortality is ascribed to shock, whereas, the particular cause of death is the sudden overwhelming dose of toxin.

With the patient in a recumbent position the colon forms three well defined fossas or paracolic pools: (1) the fossa formed between the transverse colon, the anterior abdominal wall, and the under surface of the liver and portion of the diaphragm; (2) the lateral or renal fossa, formed to the outer side of the cecum and ascending colon on the right side; and (3) the lateral, or renal fossa to the outer side of the descending colon and sigmoid on the left side. For the free drainage of fluid, however, from either lateral fossa into the pelvis requires an angulation of the body from the horizontal to approximately 35 to 45 degrees. In turn, the transverse paracolic fossa is divisible into a right and left compartment by the round and falciform ligaments of the liver.

The theory of peritoneal absorption cannot explain the mechanism of death in generalized peritonitis, although the clinical application of the Fowler position does indicate the practical usefulness of this position in preventing absorption.

There is a gastrohepatic intestinal circulation of fluid that varies from 7,000 c.c. to 10,000 c.c. per diem, and the amount of vomitus in many cases of peritonitis may easily surpass 4,000 c.c. to 5,000 c.c. per diem. This tremendous loss of gastrointestinal fluid entails a proportional loss in the sodium and chloride ions. When the latter are lost there is a disturbance in the blood chemistry and the patient is unable to retain tissue water in spite of the parenteral administration of fluids equal to that lost from the upper intestinal tract. Repetitive vomiting disturbs the acid-base mechanism and hypochloremia and alkalosis ensue. It is reasonable to infer that in gen-

eral peritonitis the major disturbance and the lethal factor is the grave chemical change which is the result of intestinal obstruction. We have repeatedly taken the material obtained by gastric drainage, or from vomiting, and re-administered it to the patient by an ileostomy tube, or through a colostomy, or even as a proctolysis. We believe that the conservation of the fluid and chemical elements of the upper intestinal tract is of immense importance in treatment. One of the grave dangers of an high ileostomy or jejunostomy is that the loss of body fluids and chemicals is literally sufficient to cause death. Orr and Haden[3] demonstrated that in upper jejunostomy the chemical and water loss was so pronounced as to produce death with changes in blood chemistry similar to those found in high intestinal obstruction. Drainage of the lower ileum did not cause such a disturbance. Furthermore, the giving of saline solutions intravenously will not protect an experimental animal from death in high jejunostomy while the same fluid will delay or prevent a fatal outcome in low ileostomy.

Intestinal obstruction as it occurs in peritonitis is due to the natural protective functions and secretory activity of the peritoneum. As an intra-abdominal infective focus irritates and invades the peritoneum, there is at first an exaggeration of normal peritoneal function, namely, an increase in the production of normal peritoneal reactive fluid. The surgeon observes this fluid repeatedly when operating in the early stages of acute appendicitis before suppuration, perforation or gangrene has taken place[4]. After a variable period the character of this fluid changes to a frank purulent exudate and serofibrinous plastic material cements adjacent bowel loops together in an effort to quarantine the peritoneal area of infection, producing the classic picture of local encapsulated peritonitis. Coincidentally, a direct inflammatory enteritis—myositis—is set up in the bowel wall and intestinal obstruction becomes imminent. In opposition to the prevailing opinion, peristalsis is not inhibited. There is, on the contrary, exaggerated peristalsis. Intestinal peristalsis proceeds from above downward. When an obstructive condition occurs anywhere between the jejunum and the cecum the peristaltic wave proceeds normally until the point of obstruction is reached. The hyperperistalsis above an obstruction carries the intestinal contents upwards and the material overflows or regurgitates into the stomach. This accounts for the copious, repetitive, effortless vomiting, so outstanding a clinical feature in diffuse or generalizing peritonitis.

In the production of intestinal obstruction in peritonitis recognition should be given to certain anatomic factors of the abdomen and its viscera. Infectious material, aided by the normal morphology of

the colon and bed posture of the patient, gravitates along either the internal or external colonic fossas into the pelvis, and every case of fatal peritonitis begins or ends with a pelvic peritonitis. The projection of the axis of the cecum and ascending colon on the right side, and the descending colon and sigmoid on the left side, forms an inverted triangle, the apex of which is at the culdesac of Douglas. In this triangle are numerous loops of small intestine and redundant sigmoid, bathed in purulent material. The result is one or more points of agglutination with angulation and enteric myositis. This mechanism, involving loops of terminal ileum on one side, with the sigmoid on the other, has been designated by Handley—"Ileus duplex"[5].

The treatment of peritonitis is largely influenced by the initial lesion and the pathologic changes that have taken place within the abdomen. Peritonitis as it is seen in clinical practice arises most frequently as a secondary complication of infection of the appendix, from perforation of the gastrointestinal tract, and from operative procedures directed against the various viscera within the abdominal cavity. The problem before the clinician is (1) to prevent the development of peritonitis; (2) to bring an advancing peritonitis into a stationary or local peritonitis, and (3) to anticipate and to prevent intestinal obstruction in progressive peritonitis. The principles of surgical therapy to be adopted will be determined largely by the duration of the condition. Therefore, we may base the treatment of peritonitis upon four periods of time and for convenience divide them into stages. It is obvious that no such arbitrary demarcation exists and that the various periods are continuous and merge one into the other in varying degrees.

I. The Stage of Anticipation

During this period, measures will be adopted to prevent the development of a progressive peritonitis. The usual preoperative treatment of Ochsner[7] and Murphy[8] will be utilized. In brief:

1. Nothing by mouth—Ochsner "Rest and starvation."
2. Gastric drainage—indwelling nasal Levine tube.
3. Fowler position. Angulation of bed, 35 degrees.
4. Morphine—gr. 1/6, p. r. n., q. 4 h. for pain or restlessness.
5. Prevent dehydration—amount of fluid lost from the stomach + 3000 c.c. per diem by:

   Murphy proctoclysis

   Tap water + 5 per cent glucose, 500 c.c. q. 8 h.

Hypodermoclysis
Tenth-normal saline—500-600 c.c. q. 8 h.

Phleboclysis
Tenth-normal saline + 5-10 per cent glucose, 1000 c.c. b. i. d. or t. i. d.

6. Prevent hypochloremia and alkalosis
Replace fluids and chlorides lost in vomitus
(a) by rectum—proctoclysis
(b) by intravenous method
(2-4 per cent hypertonic saline solution, 400-500 c.c.)
(10 c.c. solution 1:1000 hydrochloric acid, once daily.)

7. Surgical intervention.

II. The Stage of Primary Surgical Intervention.

This period will embrace three features: (1) measures directed or employed against the original surgical condition—appendicitis, cholecystitis, gastrointestinal perforation, etc.; (2) the institution of operative procedures at the time of the original operation to prevent the development of death-producing complications. The measures employed will vary with the original indication for the laparotomy but will include artificial means for drainage of the intestinal contents: (a) ileostomy: (b) jejunostomy: (c) colostomy, and (d) the institution of drainage of the primary focus of infection. Considerable surgical dialectics are always occasioned when the subject of abdominal drainage is mentioned. There is a great misunderstanding as to the purpose of abdominal drainage. Numerous contributions have been made which assumed that peritoneal drainage being a matter of pure hydrostatics cannot succeed in the abdominal cavity because in a very short time the area of drainage is excluded by a fibrinoplastic bulwark and the drain therefore ceases to function. This is a misconception of the philosophy of surgical drainage. It is readily granted, first, that the natural fluid within the peritoneal cavity, as well as the pathologic fluid present in infections, cannot be drained on the simple principle of hydrostatics. Secondly, that a drain irrespective of how it is placed or the material which is employed does not drain any abdominal fluid by gravity and that capillary drainage after a short time is arrested. The idea that a drain must function on the principle of hydrostatics is an erroneous conception. The purpose of drainage is solely to prevent the accumulation of either septic or aseptic fluids under pressure. If the fluid is aseptic it consists largely of protein derivatives and its absorption from the peritoneal cavity throws an additional increment of labor upon the liver. If it is septic it becomes a disseminating point for further infection and by constantly increasing in volume

provides a sure means of initiating a diffusing peritonitis. Therefore, the drainage of any area of the peritoneal cavity is only to prevent the products of infection from being retained under tension. If this is accomplished then the natural agglutinative processes and the natural bacteriolytic properties of the peritoneum will bring about a resolution.

A local peritonitis may be maintained as a local condition and obstruction of the small intestine prevented by utilizing a low ileostomy at the time of the operation for suppurative appendicitis with perforation. For example:

F. L. (Chart No. J6214), male, age 3 years, 6 months, was admitted to Babies Wards, New York Post-Graduate Hospital, on Oct. 11, 1935. Five days before admission the patient had been seized with acute abdominal pain, localized above the navel and accompanied by vomiting. Castor oil had been given once two days after the onset of the pain. There was no diarrhea or bloody stools and temperature never exceeded 101°. For the previous two days there had been pain on urination. Physical examination showed a well nourished boy with a flushed face. Below the umbilicus a round, tender mass could be palpated. The recti muscles were slightly rigid. The preoperative diagnosis was appendiceal abscess. On October 11, laparotomy revealed a mass about the size of a large navel orange, which proved to be a localized abscess, secondary to a perforating appendix. The walls of the abscess were formed by the cecum, terminal ileum and right lower parietal wall of the abdominal cavity. Separating the cecum from the right parietal wall, about 50 c.c. of thick, greenish pus was evacuated. The appendix was a gangrenous mass of sloughing tissue and the terminal ileum and mesentery were rigid and firm, and formed the uppermost boundary of the abscess cavity. Marked inflammatory enteritis was present. The operation consisted of an inferior right rectus incision, evacuation of the abscess cavity under adequate gauze protection, amputation of the appendix and its removal. The cecal stump of the appendix was phenolized, doubly ligated with chromic catgut, but not inverted. Following this a tube ileostomy was performed 5 inches from the ileocecal valve for the purpose of providing small intestinal drainage. Four drains were inserted, one to the pelvis, one to the base of the cecum, one to the submesenteric space of the terminal ileum, and one to the right loin below the right kidney. The wound was closed in anatomic fashion. The skin wound was only slightly approximated with three Michel clips, the edges being separated by single strip of iodoform gauze. Three days after operation a direct blood transfusion of 300 c.c. was given. On the sixth postoperative day the ileostomy tube was removed and the patient discharged nineteen days after operation.

The pathologic diagnosis was—appendicitis, subacute; severe purulent periappendicitis and peritonitis.

This case illustrates a technic that may be readily employed at the primary operation for the prevention of intestinal obstruction by ileostomy proximal to the occluded bowel, as well as the prevention of a continuing peritonitis by the institution of adequate peritoneal drainage.

III. The Stage of Surgical Intervention for "Generalized or Diffusing" Peritonitis.

Surgical measures employed for an advancing peritonitis are usually delayed until the patient is moribund. Operative intervention must be initiated before there has been too great a fluid and chemical loss from the stomach. So-called general peritonitis is curable without surgery if intestinal obstruction does not intervene. Seldom if ever is a lethal peritonitis completely generalized. Usually only the pelvis is involved in the active dissemination of the infectious process. In our experience jejunostomy and ileostomy in general peritonitis have seldom been of value. One reads the protocols on jejunostomy and is impressed with the notation "200 c.c. of fluid obtained . . . thereafter no drainage." It is quite easy to drain an isolated loop of small intestine by the introduction of a tube. It is impossible to drain effectively the entire small intestine in peritonitis except by a high jejunostomy tube.

An ileostomy in advancing peritonitis is of no value because the mechanism of retroperistalsis is already established. The fact that a patient can backtrack intestinal contents into the stomach indicates that in the presence of peritonitis there still is viability of the intestinal wall and that muscular function instead of being paralyzed is active and that the back flow or regurgitation into the stomach is due to the obstruction in advance of the contracting small intestine.

To meet the definite indication presented by intestinal obstruction in acute general peritonitis, W. Sampson Handley[5] of London, in 1925 suggested a "jejuno-colostomy followed by a cecostomy—with a minimum handling of the intestinal contents." In this country, John Wesley Long[6] of Greensboro, North Carolina, in 1926 reported his experience in three cases with the Handley combination of entero-colostomy and cecostomy. My purpose is to present our experience with the operation and to add a further suggestion for its employment in the treatment of acute intestinal obstruction not associated with general peritonitis.

Case 1.—Miss M. H. (Chart No. J562) was admitted to the Post-Graduate Hospital on March 18, 1935. The patient had been seized with intense generalized abdominal pain at 5 p. m. the day before admission, which became localized to the right lower quadrant after three or four hours. That evening the patient took 10 grains of cascara and suffered with continuous pain throughout the night and, although intermittently nauseated, did not vomit. In the early morning of March 18 she had three watery bowel movements. At 2 p. m. on the day of admission to the hospital the pain was somewhat less severe but was more pronounced in the right lower quadrant. The patient had had an abdominal operation in 1915 for suspension of the uterus and "believed the appendix was removed at that time."

On physical examination the abdomen was markedly distended. The pain and tenderness were marked on the right side. The preoperative diagnosis was possibly acute appendicitis (ruptured) or possibly an ovarian tumor with twisted pedicle. Laparotomy was performed 1 hour and 42 minutes after the patient was admitted to the hospital. It was found that the patient had had a previous ventrosuspension, with a right oophorectomy. The appendix, however, was found in an acute condition, with some free pus beneath the cecum. The right tube was attached to the base of the cecum and had undergone a torsion of 180 degrees, producing a gangrene of the oviduct and the upper half of the right broad ligament. There was about 100 c.c. of thin, blood-stained purulent material in the right side of the pelvis, which communicated with the purulent collection beneath the cecum. The former median scar was excised and the abdominal cavity opened. The omentum was separated from the under surface of the abdominal wall. The purulent material was aspirated and the cecum separated from the right broad ligament, and a typical appendectomy with inversion of the stump performed. Following this a resection of the right broad ligament was carried out, removing the right tube. Rubber tissue drainage was placed low down in the pelvis and to the base of the cecum. The pathologic diagnosis on the material removed was "marked purulent inflammation, abscess formation of the right oviduct; acute purulent salpingitis, acute purulent peritonitis, local; appendix inactive, partial obliteration of the lumen."

Following the operation the patient did fairly well for 48 hours and expelled 400 c.c. of material through a rectal tube. At the beginning of the third day the abdomen became distended, temperature 102, pulse 108, respirations 26. On the third day a small amount of flatus was expelled with brown fluid by an enema. However, the abdominal distention became more marked. At this time there was profuse drainage from the wound of a foul-smelling discharge.

On March 23, the fifth day after operation, the abdominal distention was more pronounced than the previous day, and the patient began to vomit. On the sixth day she vomited 100 c.c. of green fluid, followed six hours later by 400 c.c. of green fluid, with lessening of the distention. On the morning of the 24th, she vomited 800 c.c. of yellow material, followed four hours later by 600 c.c. and two hours later by 500 c.c. The diagnosis of "ileus duplex" was made, secondary to a diffuse peritonitis and the Handley operation was performed that day. The operation consisted of preliminary closure of the infected lower abdominal wound by packing and silk worm ligatures and hermetically sealing off the area for the duration of the operation. Following which the upper abdomen was prepared with the most rigid aseptic control, and under local 2 per cent procaine anesthesia, an incision was made through the middle of the left upper rectus muscle and entrance into the upper abdomen obtained. Lying in the field was the omentum. This was divided transversely and longitudinally and the under surface of the transverse colon was identified. The uppermost presenting loop of the jejunum was picked up and a lateral anastomosis performed between the jejunum and transverse colon. There was some slight soiling but the surrounding tissues were adequately protected by laparotomy pads. Following the lateral anastomosis the defect in the omentum was repaired with interrupted catgut sutures and the abdomen closed without drainage. A second incision was made paralleling the right costal margin and a portion of the ascending colon was picked up and an aseptic colostomy performed by the introduction of a self-retaining Pezzar catheter. The skin wound was loosely approximated around the catheter and two rubber tissue drains were inserted in the area of the colostomy wound. A Levine tube

was allowed to remain in the stomach. Following the operation the patient was markedly sick and during the first 24 hours the temperature reached 105, pulse 130. From this time there was a slow convalescence. The patient was discharged on April 10, 1935, with a dry wound and bowel function normal.

After history:—This patient returned to work and enjoyed excellent health until about 26 months after her operation when she began to have attacks of diarrhea, which would usually last for a week or ten days; after being hospitalized the diarrhea would cease and the patient would return to her habitual employment as a supervising nurse within the hospital. In October, 1937, however, the diarrhea became more persistent and after a thorough canvass of all of the possibilities, the cause of the diarrhea was ascribed to the delivery of high jejunal contents into the terminal half of the large bowel. In the meantime there had been considerable anemia, and it was decided to close the jejunocolostomy. A laparotomy was performed on Nov. 13, 1937, by excision of the cicatrix of the former left upper rectus abdominal incision. It was found that the omentum was adherent to the anterior abdominal wall and when this was separated the jejunum was found to be hypertrophied and its lumen larger than the stature and weight of the patient would suggest. The anastomosis between the jejunum and the midportion of the transverse colon was free of any adhesions and there was no marginal ulcer present. There was a sort of tubularization of the anastomosis as if there had been a stretching out of a portion of the jejunum and of the transverse colon to make a tube connection between the two viscera. The stoma was unusually wide, admitting three fingers. Two rubber protected clamps were applied to the tubular portion of the anastomosis and the connection divided. A typical enterorrhaphy was performed on the small intestine and a typical colporrhaphy on the colon. Both suture lines were reinforced and the abdomen closed in anatomic fashion. The patient made an uneventful recovery and was discharged from the hospital at the end of sixteen days, since which time she has gained 26 pounds in weight, and has, in her own words, "never felt better."

Comment:—There can be no doubt that the persistence of a high jejunocolostomy will be associated with the possibility of severe diarrhea and general nutritional loss. It is evident that the stoma in this case was much too large and was unable to contract down and relatively disappear through non-use. The experience with this case would seem to suggest that the stoma need be no longer than that produced by a small size Murphy button.

Case 2.—Miss R. B. (Case No. 637023), was seen in consultation eight days after appendectomy and myomectomy. For 48 hours after her operation the patient had had a normal course, after which time she had begun to vomit, first, small quantities of fluid and then amounts running up to a total of 3,600 c.c. on the fourth day after operation. On examination the abdomen showed a lower laparotomy incision, with union per primam, a uniformly distended abdomen and the diagnosis was made of a general diffusing peritonitis. The family and relatives were informed as to the general hopelessness of the situation unless attempts were made to correct the condition by operative intervention. After obtaining their consent a second laparotomy was performed on Nov. 23, 1936.

Under spinal anesthesia an incision was made through the middle portion of the upper right rectus muscle. On opening the abdomen all of the small

intestines above the level of the navel were found to be markedly distended and intensely hyperemic. The small intestines in the region of the cecum were fixed and adherent in the culdesac. About 150 c.c. of thick blood-stained fluid, with foul odor, escaped from the pelvis. The general picture was that of intestinal obstruction secondary to a diffuse pelvic peritonitis. The free peritoneal fluid was siphoned away and a laparotomy pad placed in the pelvis. The omentum was displaced upwards and to the left and the uppermost coil of distended jejunum was brought into lateral apposition with the transverse colon and a jejunocolostomy performed. Number 1 chromic catgut was used and the method followed the accepted technic. The abdominal incision was closed after which an incision 5 cm. in length was made in the right mid-axillary line and paralleling the costal margin. The ascending colon or hepatic flexure was withdrawn into the wound and a colostomy performed by the introduction of a Pezzar self-retaining catheter. There was some soiling of this wound by the escape of gas and fecal material. A rubber tissue drain was inserted below the hepatic flexure to Morrison's space and the abdominal parieties kept open by means of a single strip of iodoform gauze. During the operation the patient received 1,500 c.c. of normal saline and an indwelling gastric tube was left in situ. From the time of this operation the patient did not vomit and in the first 12 hours only 150 c.c. of fluid was obtained through the Levine tube. The Levine tube was removed at the end of 24 hours and the patient made an uneventful convalescence, but required a rather prolonged stay in the hospital for recuperation, being discharged 28 days after her second operation.

IV. The Stage of Postoperative Therapy

This period embraces all the measures advocated under adequate preoperative treatment as suggested for stage I.

A further suggestion for the employment of the Handley operation is in its applicability in the surgical treatment of postoperative intestinal obstruction. Intestinal obstruction due to the formation of adhesive bands producing angulation, obstruction and volvulus is a complication of great magnitude and danger and if unrelieved a fatal termination may be expected.

Over varying periods of time the patient's water and chemical balance may be maintained by parenteral administration of fluids. Furthermore, the introduction of an indwelling nasal tube or the use of the Wangensteen apparatus can maintain the stomach in a condition of almost complete deflation and the material drained from the stomach may be re-introduced into the body in some cases by proctoclysis. No accurate estimation of chemical or water absorption, however, can be deduced from the quantity given by proctoclysis, and at the present time it is a matter of doubt as to how much of the essential intestinal by-products may or can be absorbed from a colon in the presence of such a grave intra-abdominal disturbance as is associated with intestinal obstruction.

By the utilization of adequate amounts of normal and hypertonic sodium chloride and glucose intravenously, and continuous aspiration of the stomach, these patients can be made so comfortable that the pain incident to intestinal obstruction is obviated and a false sense of security may be conveyed to the attending surgeon. These patients may carry on over a number of days and exhibit a rather fair clinical picture, when suddenly with terrible rapidity collapse intervenes, and they die.

It is a devastating experience to be called upon to operate for intestinal obstruction in a patient that has been markedly depleted; to handle red, distended intestines that are adherent at a number of points and which when separated leave areas with a loss of serosa and protruding diverticula of the mucous membrane. The immediate postoperative reaction from such a laparotomy is many times overwhelming with a rapidly ascending temperature, 104-105, and early demise. Operations that open the bowel and deflate them are associated with soiling no matter what the technic employed. Given a patient with the clinical symptoms of intestinal obstruction occurring after operation the utilization of the Handley procedure should be life saving. Under spinal or local anesthesia a jejunocolostomy may be performed with less trauma, less shock than an exploratory laparotomy for the obstruction. The maintenance of the life of the patient for a varying period of time by the Handley operation will allow the inflammatory change and myositis in the obstructive bowel to subside. With the cessation of these two elements the contents of the bowel will pass through even an anchored or angulated small bowel. It has been our experience to have a few cases in which a perfectly clean, aseptic primary operation was performed, such as hysterectomy or appendectomy, to have these patients develop multiple obstructions of the small intestine. On exploratory laparotomy there was found no element of infectious peritonitis, but marked cementing with a fibrinoplastic material of adjacent loops of intestine. It would appear that in certain patients there is a pernicious chemical by-product from the traumatized peritoneum that is out of all proportion to the operative trauma inflicted. At a secondary laparotomy after the surgeon has separated all of the coils of intestine there has been inflicted a greater degree of surgical trauma than ar the first operation. Furthermore, there is always the possibility of the rapid reformation of obstruction. Jejunocolostomy plus cecostomy would obviate this traumatism and allow the patient to survive until nature overcomes the inflammatory changes in the bowel sufficiently to allow the passage of intestinal contents.

Finally, to quote Handley, "Sir Cuthbert Wallace laconically stated in a recent discussion 'If the bowels can be made to act, the

patient recovers; if they fail to act, he dies'—a fact which is conclusive as to the importance of obstruction. It is the predominant lethal factor in these cases."

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BILATERAL PNEUMOTHORAX AND EXTENSIVE SUBCUTANEOUS EMPHYSEMA COMPLICATING GASTRIC RESECTION

Report of a Case

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AN extensive subcutaneous emphysema associated with bilateral pneumothorax following an abdominal operation must be a rare occurrence. We have found no similar report in the literature.

REPORT OF CASE

A white male, 29 years of age, had had symptoms of stomach trouble for fourteen years. A definite diagnosis of duodenal ulcer was made when he was 18, and Sippy treatment gave complete relief. The trouble recurred, however, in a year and, though not seasonal, was intermittent up to the present. During these ten years he had been on very strict diets for various lengths of time. He is a salesman who works under high pressure and has not been able to take proper care of himself.

One year ago he was treated for a depression state and at the same time made a slight change in his occupation. However his stomach trouble was not obviated; it progressed until it was almost unbearable. Pain radiated through to the back and occurred severely at night associated with vomiting.

X-ray examination showed a deformity of the duodenum with a crater on the posterior wall. The patient wished to avoid operation and was put in a hospital on a strict medical regime. There was temporary improvement but night pain and retention were uncontrollable. For relief it was necessary to administer a narcotic and even that had little effect. He was urged to submit to surgery.

On Feb. 6, 1937, exploration through a high left rectus incision revealed a subacute duodenal ulcer, which had perforated onto the pancreas, forming an inflammatory mass about 2 cm. in diameter. The stomach was divided above the pylorus and it was possible to invert the distal end satisfactorily in spite of the inflammatory reaction in the duodenum. After removal of five-sixths of the stomach, the operation was completed as a posterior Polya procedure.

Examination of the specimen revealed an extensive hemorrhagic gastritis.

The patient did not take the gas-ether anesthetic well, and at the end of the operation, the anesthetist noticed a slight swelling of his neck. By the time the patient had reached his room, this swelling had spread over the entire anterior chest, shoulders and neck, and was definitely extensive subcutaneous emphysema. There was difficulty in breathing and marked cyanosis. Oxygen therapy was started at once. The emphysema increased for several hours and then seemed to remain stationary.

The next day the temperature reached 103.4. On the day following, a bedside x-ray of the chest showed a partial pneumothorax on the right side, the upper lobe only being collapsed. The right lung seemed adherent to the lateral chest wall at the second interspace. Air was present in the subcutaneous tissue.

The emphysema began to decrease on the second day and was gone by February 15. The patient had, however, a rather severe cough and was expectorating much mucopurulent material.

Fig. 1. There is a pneumothorax compressing the right upper lobe with practically complete collapse. The lower lobes show no collapse.

When he was fever-free on February 17, he was taken to the x-ray room for a stereoscopic roentgenogram, which showed a bilateral pneumothorax with the right upper lobe entirely collapsed and a large amount of air over the entire left lung. At this time there was still a good deal of drainage from the wound, apparently from the site of the perforation onto the pancreas. As the coughing continued there was some drainage, which must have come from a small duodenal fistula which subsequently closed.

On February 22, another x-ray showed less air in both pleural cavities, and the patient was allowed to leave the hospital. At that time the stomach was working well on frequent feedings of selected food. A little drainage from the incision continued and an aggravating cough persisted. During the next two weeks there were two or three episodes of sudden dyspnea following exertion, and it was found on examination of the chest that there had been an increase in the extent of pneumothorax, especially on the left side. Apparently a bronchial fistula had been reopened. After these episodes stopped, the patient progressed satisfactorily and has since been taking a general diet. He is carrying on his normal duties at this time without any gastric or pulmonary distress.

The mechanism producing this unusual complication is hard to explain. It seems to us most likely that there were bilateral emphysematous blebs and, following strain of anesthesia, one rup-

tured on the right side, followed by pneumothorax and a passage of air up through the mediastinum into the neck and over the chest. For the pneumothorax to develop on the left side at a later date, it is probable that in a coughing spell another emphysematous bleb ruptured on this side. It does not seem possible that there was enough pneumothorax on the right side to push across the mediastinum and cause a pneumothorax on the left side.

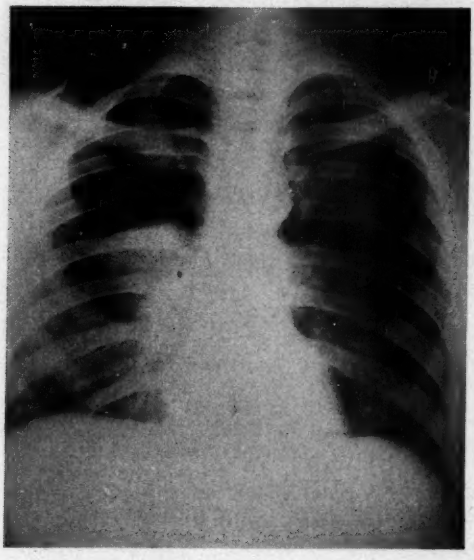

Fig. 2. The pneumothorax on the right side involves the entire upper chest. On the left side there is about a third compression of the entire lung by air.

It may be that during anesthesia an adhesion between the visceral and parietal pleura was torn loose, with a resultant bronchial fistula which allowed the escape of air into the chest cavity and into the tissues. We also considered the possibility of the presence of a foreign body, but this was excluded. There could have been a tracheal injury from a suction tip.

In any event, the complication was self-limiting and, although embarrassing for a time, the patient experienced no great difficulty and at the present time is well. Late x-rays of the chest are entirely negative.

THE DIAGNOSIS AND MANAGEMENT OF ACUTE GALLBLADDER DISEASE

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FIFTEEN or twenty years ago the principal debate in gallbladder surgery revolved about the question of whether to remove or drain the diseased gallbladder. That argument has been settled by the usual preference at this time for cholecystectomy over cholecystostomy. Most surgeons remove the gallbladder routinely and drain it only occasionally and then for special indications. However, there is now a new problem in this branch of surgery. It has to deal with the proper management of the acute disease of the gallbladder. At one extreme is the group who consider acute cholecystitis in the same category with acute appendicitis and advocate immediate operation as in other emergency cases. At the other extreme is a much larger group who advocate a waiting policy to allow the gallbladder to cool down followed some time later by an interval operation to affect a cure of the disease. This opinion has been so effectively presented for such a long time that most general practitioners follow that plan of treatment. Between these two extremes there is a middle group continually growing in numbers, who advocate a short period of close observation followed by prompt operation if immediate improvement does not occur. In order to evaluate the merits of these various plans it is necessary to consider briefly the pathologic changes shown in acute gallbladder disease.

Pathology

Most clinicians are agreed that the first change occurring is a vascular one brought about by a partial occlusion of the venous return from the gallbladder and that infection of the wall occurs secondarily which is the reverse of the process appearing in acute appendicitis. This edema of the gallbladder wall results in an increased obstruction of the cystic duct and the type of contents trapped in the viscus depends upon the previous condition of the gallbladder. If it has been functioning in a fairly normal manner rather healthy bile will be found. If on the other hand the acute attack is really an acute exacerbation of disease in a chronically obstructed gallbladder, hydrops or empyema will be observed. In either instance the edema may subside with the relief of obstruction in the acute cases or a return to the previous condition in the chronic cases. In some instances, though, this fortunate change does not occur. Instead, the edema progresses and the second stage of the disease is evidenced by the appearance of a variable amount of infec-

tion. Even this too may subside if the obstruction is not too complete or too prolonged. However, if the infection is progressive and suppuration increases perforation may occur. The usual route is into the peritoneal cavity with a moderate extravasation of the infective material. That this is not the only route available was shown by one of my own cases where the perforation occurred through the posterior wall into the liver with the development of multiple abscesses of that organ. The third stage of the disease is evidenced by the development of gangrene which may be local or generalized. At this stage, of course, perforation is much more likely to occur. One reason why initial attacks must be observed, if anything, more closely than acute exacerbations in old obstructed cases is because there is more likelihood of this complication appearing in the former cases since the gallbladder wall is not so thick and fibrous as it is in those where there has been a chronic inflammatory process. Perforation is not so infrequent as one might think. For example, in one series of patients treated by the waiting method, eight cases of perforation were reported. If the perforation occurs into the liver the prognosis is bad; if it occurs into the peritoneal cavity the mortality and morbidity are increased and the operative difficulties are multiplied. In those cases where perforation does not occur and the acuteness of the gallbladder disease subsides, adhesions and fibrosis are quite likely to make subsequent operation more difficult than operation in the acute stage where the gallbladder will frequently shell out fairly easily.

Accompanying any of the acute stages of gallbladder disease there will be some degree of impairment of liver function usually with a decrease in the glycogen reserve. This is a point that should be recalled by those who advocate an emergency operation without time for preoperative administration of glucose. Neglect of this measure is quite likely to be evidenced by an increased mortality rate.

Diagnosis

While all the signs and symptoms of acute gallbladder disease are frequently not found in any one particular case the diagnosis as a rule is fairly easy to make. The first symptom is the rather sudden onset of pain in the right upper quadrant. This pain is usually severe, fairly well localized, dull and constant rather than cramplike, and accompanied by definite tenderness and abdominal rigidity. The degree of rigidity present in the area where it is necessarily found may well prevent the palpation of a mass and the determination of the amount of obstruction present. The fever is not uniformly high, often not in keeping with the severity of the other symptoms. The pulse conforms fairly well with the temperature. There is practi-

cally always some nausea and vomiting. Chills may or may not occur. A history of previous biliary disease is not essential in making a diagnosis. The majority of cases show no jaundice and it has been observed that the most serious cases are perhaps the least likely to show this symptom. While the leukocyte count and polymorphonuclear percentage usually show considerable elevation and offer some index to the severity of the condition, this finding is not as consistent as in other diseases, as for example, acute appendicitis, where the pathologic change is primarily one of suppuration.

From the standpoint of differential diagnosis a number of possibilities may be considered. In uncomplicated gallstone colic the pain is more cramplike and quite frequently is referred to the right shoulder. Rigidity is less in such cases and evidences of infection are absent. A perforated peptic ulcer causes more diffuse pain and the characteristic boardlike rigidity of the entire abdominal wall. A subphrenic abscess usually has a history of an antecedent cause. While a high retrocecal appendix, acutely inflamed, may give confusing physical signs, the symptoms of the attack will generally suffice to make the differentiation. The possibility of renal colic should be eliminated by the type and location of the pain, and pyelitis by the urinary findings. Pneumonia of the right base and pleurisy can generally be recognized by physical examination of the chest. The apparently increasing incidence of coronary heart disease adds new difficulties but if the usual drop in blood pressure and pulse rate, the evidences of shock, and the previous history of other distribution of the pain are not conclusive there is always time for an electrocardiogram.

Management

Formerly, and perhaps even now, the usual management of a case of acute gallbladder disease has been rest in bed, local application of ice, limitation of diet, plentiful intake of fluids and glucose, and relief of pain as required. Since operation was generally postponed until the acuteness of the condition had subsided many of these cases were not hospitalized for observation. However, Taylor, Zinniger, Graham, Mentzer and others have in recent years analyzed large groups of cases and consistently show rather startling findings. The series of eight perforations in one group has been cited. Another observation made in more than one series is that approximately one third of the cases improve, another third show no change, and the other third become worse while under observation.

Those cases which are going to improve without operation will generally do so in 48 to 72 hours. Since all cases will not require

operation, surgery may be postponed or even indefinitely deferred in this group. The precaution to be observed here is to remember that these cases are occasionally not so safe as they appear. One must be quite certain that definite improvement is taking place. Such information can best be obtained when the patient is hospitalized and frequent temperature readings and blood counts made.

The controversial point of the management is not so much concerned with which cases to operate on but when to operate. Patients who do not respond to the above treatment or patients admitted to the hospital very sick several days after the onset of the illness will probably have to have surgical relief. Postponement of such relief beyond the fourth or fifth day shows a tremendously increased mortality—in one report from 5 to 23 per cent. While this, of course, is the all important factor to both patient and surgeon, the increase in the number of postoperative complications and required hospital days are also factors to be considered.

Because these patients are usually seriously ill and have some liver impairment it is fortunate that they are seldom emergency cases. In practically every instance there is adequate time for preoperative administration of the necessary glucose and fluids.

The type of operation is perhaps not so important as the time. Cholecystectomy can usually be done and either it or the destruction of the gallbladder mucosa is preferable to simple drainage where possible because the reported mortality is less.

Conclusion

While acute gallbladder disease is not particularly common, it is a dangerous disease: probably its serious possibilities have not been appreciated. Because these cases are not frequent any one man's impressions may not be accurate. A careful analysis of large series of cases, though, prove rather conclusively that the majority of patients are not benefited by watchful waiting longer than three to five days from the onset of the illness, (not the beginning of hospitalization) and that about one third become definitely worse. Since there appears to be a distinctly decreased mortality as well as a lowered morbidity when operation is performed early it would seem that the best management of these cases would be prompt hospitalization, careful observation, administration of fluids and glucose, and exploration in three or four days unless the fever, leukocytosis, tenderness and rigidity promptly subside. The operation of choice is cholecystectomy as it is usually possible and gives complete relief. It is recognized, however, that drainage alone is all that can be done in some instances.

PHYSIOLOGIC REST IN THE EARLY AFTER-CARE OF POLIOMYELITIS

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THE object of this paper is to make a plea that adequate rest be provided for the patient convalescing from an attack of poliomyelitis. Adequate rest implies not only limitation of normal activity, even to the degree of complete rest in bed, but, in addition, includes physiologic rest for the involved muscle groups. This rest can only be supplied by the assistance of appropriate mechanical support. This support may consist of plaster casts or splints, or a combination of both.

The place of rest in the after-treatment of poliomyelitis, particularly for the first few months following the acute attack, is well understood by the majority of orthopedic surgeons as well as by many physicians in general practice. Poliomyelitis, as compared with the well known acute infectious diseases such as influenza or diphtheria, is not often encountered by the general practitioner. Naturally, when the responsibility of caring for this type of case rests upon him there may be some uncertainty as to the proper approach to the problem. The approach may be so obscure or confused, due to the complexity of the involvement and the individuality of each case, that this care may be abused or neglected entirely. The majority of these patients will recover from the acute illness and make some spontaneous gain in muscle power without any orthopedic care, but not one escapes some degree of irreparable injury and a prolonged convalescence without proper treatment early in the paralytic stage.

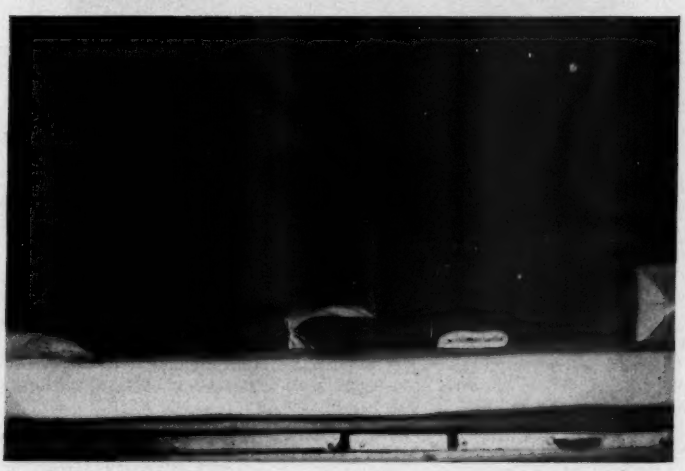
In discussing the care of the patient with a residual weakness, or paralysis, one should realize now that he is no longer dealing with the treatment of poliomyelitis. The actual disease is over and the attending physician is facing the damage after the tornado has passed. At this time he faces at least two obligations—first, the obligation to the patient to preserve all potential muscle power and prevent the occurrence of deformities; second, the task of resisting the natural insistence of an overzealous parent, or patient, that he do something for the paralyzed muscles. In these cases the physician must strongly maintain an attitude of inactivity. The management now is essentially the same as that for a peripheral nerve injury which, as is well known, is rest, followed later by appropriate exercise. Often the muscle damage is so severe that actually there

is little or no muscle tissue to exercise and the patient is carried through a series of passive motions which simply stretch out the muscle fibers remaining intact as well as the ligamentous structures about the joints. Rest is the important treatment most commonly abused. The recovery of an extensively damaged muscle is never complete if some of its representative nerve cells in the spinal cord have been destroyed. Likewise, one may say the future potential strength of a muscle can be measured by its representative neurones remaining intact. It is these remaining muscle fibers which require meticulous care to prevent permanent injury. Stretching and tearing of these muscle fibers and the interfibrillar bands result in hemorrhage from the rupture of the tiny blood vessels. These hemorrhagic areas undergo organization, forming fibrous tissue. This, theoretically, interrupts the continuity of the muscle fibers, the muscle and fascia being bound together in an inelastic mass. An irreparable injury has been done and the power of the muscle as a whole has been permanently diminished. The unavoidable destruction during the natural course of the disease is often extensive and extremely disabling without adding further to the disability and prolonging convalescence through neglect or unwise management. Often, in the effort to regain muscle power, disabling deformities are allowed to develop which would prevent normal function of an extremity even though the musculature had never been damaged. The bony framework of a normal body, connected by joints for flexibility, is maintained in a state of balance by the action of groups of muscles. When the action of one or more of these muscles is removed, wholly or in part, by paralysis or weakness, a state of imbalance exists and constant strain is thrown on this framework and its connecting structures, the degree of this imbalance being in direct proportion to the extent of the damage and the number and location of the involved muscles.

Myalgia, or muscle pain, is one of the most distressing symptoms experienced by the acutely paralyzed patient. He assumes various unfavorable positions in an effort to relieve his pain at the expense of the ultimate degree of improvement possible to obtain. Oftentimes one sees the patient lying in bed with the knees drawn up toward the chin, thighs flexed on the trunk, knees flexed, and the feet in a dropped position. Weakened muscles are being stretched out, adding 'stretch paralysis' to that already present as a result of the disease. In a very short time contractures will develop in the relaxed groups which require some special form of correction before further treatment can be undertaken.

In applying mechanical support, correct positions must always be kept in mind. These positions are determined by the location

and degree of muscle damage. They are influenced by the pull of gravity and care must be taken always to preserve the normal weight bearing lines. An extremity is supported in a position to overcome the pull of stronger muscles and provide relaxation for the weaker opposing groups. When the opposing groups on either side of a joint are equally involved one must then bear in mind, in applying support, the muscle of most importance in performing functions

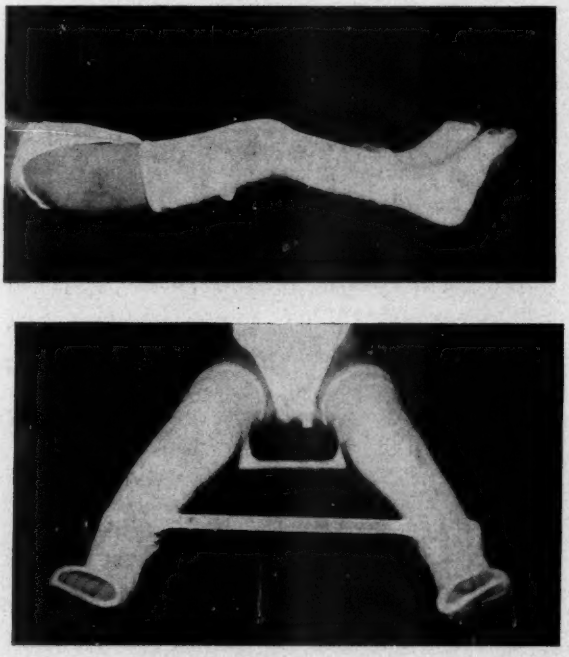


CORRECT POSITION FOR BED REST BEFORE ANY SUPPORT IS APPLIED

Board has been placed between springs and mattress. Note position of arms, back, knees, and feet.

characteristic of this extremity. As an example, the structures behind the thigh and in the calf are given preference over those in front of the thigh and leg. A knee joint well fortified posteriorly with strong ligamentous structures and muscles including hamstrings and the calf group will make a better weight bearing extremity than

one with strong quadriceps and dorsiflexors of foot and weak structures behind the knee. In an upper extremity flexion at the elbow is preferable. The biceps is more useful than the triceps as it takes muscle power to get the hand to the mouth while gravity, of course, will straighten the forearm.



LOWER EXTREMITIES IMMOBILIZED IN OPTIMUM POSITIONS

Note slight flexion of knees, mild equinus of feet, and abduction and internal rotation of thighs at the hip.

These positions overcome the pull of gravity and favor the muscle groups behind the thigh and calf. These posterior groups are most important in weight bearing either with or without support.

Often it is necessary to immobilize the extremity for the relief of pain or for rest before a muscle analysis can be made. In these cases optimum positions must be kept in mind. Optimum position is that position which preserves the normal weight bearing lines in the lower extremities, maintains the normal curves and alignment of the spine, and places upper extremities in best position for function. The patient is placed flat on his back in a bed which does not sag—boards placed between springs and mattress will prevent sagging. A curving bed predisposes to flexion contracture of the hips, obliterates the normal lumbar lordosis, resulting in a flattened lower back.

The tips of the shoulders are pushed forward, allowing the pectoral groups to tighten up, resulting in rounded shoulders.

Lower extremities are best immobilized in plaster casts, the feet midway between eversion and inversion and in slight equinus to favor the calf groups. Care must be taken to maintain the ankle and knee joints in the same vertical plane. Without support gravity tends to rotate the foot and leg externally on the thigh. This rotation takes place first in the knee joint and later in the tibia itself. A fixed bony deformity is the result. The knees are flexed about 10 or 15 degrees to favor the structures behind the knee and thigh. An extremity put up straight at the knee will be found hyperextended when the cast is removed. This is due to atrophy and the pull of gravity. If two casts are indicated they are fastened together by a cross bar with the thighs abducted and internally rotated at the hips as it is felt that abductors and internal rotators are more important in walking than adductors and external rotators.

If there is a history of respiratory involvement, the abdominal groups are splinted by some type of body brace or corset. Overactivity of the diaphragm and stretching of abdominal muscles is thus avoided and the chest is left free for expansion. Contractures of the rib cage at the end of expiration results from weakness of the muscles of inspiration and limitation of chest expansion as well as deformities of the thoracic cage will develop.

Arms with deltoid weakness are best supported in a horizontal position by sand bags, slings fastened to the head of the bed, or splints. Forearms are placed midway between supination and pronation. Particular care should be given to the thumb as a hand without a useful thumb is little more than a hook. The thumb is abducted from the index finger and rolled in toward the palmar surface of the hand as if one were trying to touch the tip of the little finger with the tip of the thumb.

Plaster of Paris for immobilization of lower extremities and trunk is preferred to other types of mechanical support. It is more positive, more comfortable, and, by far, the least expensive. Splints that do not fit properly will produce more deformities than they prevent and stretch out more muscles than they protect. The services of an experienced brace maker are required to construct a splint that fits properly. These shops are usually located a considerable distance from the patient. This adds to the expense and makes it impossible to have the several fittings necessary to make the splint correctly. Orthopedic appliances cannot be supplied by the mail order house method—they have to be built on the patient.

Orthopedic experience is necessary for proper supervision of the extremities immobilized by removable splints. All that has been gained in 24 hours of rest can be destroyed in 5 minutes by careless handling of the extremity in putting on or removing splints.

In the growing child plaster is especially preferred. Casts are removed every few weeks to allow muscle rechecks and new ones applied with the extremities in the position the muscle set-up and deforming tendencies require. A positive, efficient, and fool-proof support has been provided at a minimum cost.

Some type of removable splinting is preferable for upper extremities. This is particularly true of the hand. Fingers will stiffen in a short time if held in a fixed position. Some motion every day is necessary. Hands do not require a heavy or strong support. They are not concerned with weight bearing, but with the finer movements characteristic of their function.

These few principles which have been proven at Warm Springs in treating the acutely paralyzed poliomyelitis patient have been expressed in a brief and general way. All these principles are applicable in the measures indicated before orthopedic supervision can be obtained for one reason or another. The principles are those for a peripheral nerve injury. Everyone knows a cock-up splint for the wrist is indicated in treating an injury to the radial nerve. Exercises, if properly given and supervised, plus adequate removable splinting constitute the next phase in treatment of poliomyelitis. This treatment is best given in a medium of warm water. The trend is toward instituting exercises too early after the acute attack or to delay any treatment until exercises can be started. No fixed time to begin this phase of treatment will fit all cases. Each patient presents an individual problem and must be handled as such.

It would take much more space to discuss, in a most general way, this phase of treatment with all its ramifications than has been taken to present very briefly a resumé of physiologic rest.

SAFETY PIN IN THE ALIMENTARY TRACT

Diagnosis, Treatment, Dangers, Complications

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and

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SAFETY pins are swallowed either accidentally or intentionally much more frequently than is generally supposed. Certain types of feeble-minded individuals sometimes have the habit of swallowing all manner of metallic objects including open safety pins. Oddly enough, when swallowed by such individuals they do not seem to do any special harm. In cases of this kind, therefore, which we have seen, no special treatment has been carried out on the basis that no complications had occurred and the patient, as soon as dismissed from treatment, would probably load up his stomach again with the same things. One exception was that of a patient with a fish hook impaled in his esophagus and several fence staples and another fish hook traveling through the small intestine. The hook in the esophagus was removed by Dr. Stutsman. The other objects passed.

On the other hand, when an open safety pin is swallowed by an infant or young child, the situation is quite different. As is generally known, babies cram anything they can lay their hands on into their mouths and the reason they so often get safety pins is because they are used in their clothing or left where they can reach them. Occasionally the pin will fall from the mother's dress while she is bending over the baby and into the baby's mouth. We have had two such cases. Recently we had a case of an infant under a year old, who had actually unfastened the safety pin from the under-surface of the floor cover of his play pen, put it in his mouth and swallowed it.

When a closed safety pin is swallowed, it may confidently be expected to pass, but x-ray study must be carried out to determine whether it is in the esophagus or tracheobronchial tree. Safety pins, whether open or closed, lie in the coronal plane when in the esophagus. When in the tracheobronchial tree they be in any plane. They are usually found in the esophagus rather than in the tracheobronchial tree. When open and impaled, the situation at once becomes serious, the degree of seriousness depending on several factors such as direction of the point, size of the pin, degree of penetration of the esophageal wall, duration of sojourn of the pin, age of patient and treatment employed. It is of interest also that whereas in most

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instances someone knows when a child swallows a safety pin, this is not always true, the pin occasionally being discovered accidentally during the course of an x-ray examination for unknown cause of symptoms such as fever, cough, dysphagia or unexplained lung inflammation.

When a safety pin is open in the esophagus with the point down, it is comparatively simple with the aid of an esophagoscope to pick it up by the presenting portion, which is the spring, and pull it into the scope. When impaled in the esophagus with the point up, the method of relieving the situation is entirely different. If traction is made on a safety pin open in the esophagus, point up, without sheathing the point, it is certain to penetrate and tear the wall of the esophagus and adjacent tissues. If in the thorax the mediastinum will be entered. This is almost certain to result in laceration of the pleura or the great vessels with fatal pneumothorax or hemorrhage. If in the cervical region the great vessels are likely to be opened. Blind bouginage by the use of instruments such as stomach tubes, coin catchers or other instruments which are pushed down the esophagus or unskillful use of the esophagoscope is likely to produce tears. (See Case No. 1.) For this reason efforts at dislodging safety pins or other sharp objects from the esophagus by blind bouginage cannot be too strongly condemned.

Jackson[1] has described numerous methods, (sixteen in all), and instruments, including closers and cutters for dealing with open safety pins in the esophagus. We have employed these methods, but for several years now we have been doing endogastric version on practically all, with the exception of those in the hypopharynx, with the aid and guidance of the biplane fluoroscope. Instead of troubling to catch through the hole in the spring, as taught by Jackson, we catch by the shaft with rotating forceps between spring and keeper, and push pin, scope and all into the stomach under fluoroscopic guidance, where the stomach bubble increases visibility. Then by a movement which is a combination of rotation and withdrawal the point of the pin is turned downward and the spring upward and promptly drawn into the scope which is then removed.

In babies and very young children, laryngeal compression and serious interference with breathing is likely to occur. Oxygen during the operation (which should not require more than one to three minutes) will alleviate this difficulty but the child must be watched carefully with the aid of a flashlight since of course the operation is being carried out in a dark room.

It is customary in our service to fluoroscope these patients immediately before esophagoscopy because pins have a way of moving down

into the stomach. When found in the stomach, unless our instruments have already been introduced, it is our practice to let them pass on through the intestinal canal which they will almost invariably do, provided the family and the surgeon can be persuaded to let nature take its course. One of our cases, however, proved to be an exception, as shown in Case 2. No cathartic or other special measures are needed nor should be permitted unless constipation occurs and then only of the mildest sort combined with plenty of coarse food which will cover and wrap up the pin. If it is thought necessary to remove a pin surgically from the stomach, a very simple method, after the stomach is in hand, is to push the pin point through the gastric wall and up to the spring and a very small knick will permit the passage of the spring and keeper. Preferable to this, however, would be removal through the esophagoscope with the aid of the biplane fluoroscope. Pins may remain in the stomach for a surprisingly long time without apparent harm and then pass. As we have found, a safety pin may also remain in the esophagus in the occasional case over a prolonged period without discovery but as a rule within a few weeks the presence of the pin is discovered as a result of complications which occur.

Report of Cases

Case 1.—C. W., age 1 year, was admitted to St. Louis Childrens Hospital April 9, 1934, with a history of low grade fever for five weeks. He had rather marked hemoptosis for one day, pallor for one week, choking, stupor and anorexia for one day. The history dated back some five weeks before admission at which time he was thought to have swallowed a grain of corn. He choked, became slightly cyanotic and coughed a great deal for a few hours, after which he did not appear any the worse for about 24 hours. He then developed what was thought to be bronchopneumonia. He carried along with this until it was thought that he had developed fluid in his chest and an x-ray picture was made. An open safety-pin in the esophagus, with the point up, was discovered. Then a stomach tube was pushed down his esophagus apparently with the idea of removing the safety pin. The safety pin was not brought forth but the child did vomit a considerable amount of blood and for the next 24 hours continued to vomit blood occasionally. He was then brought to the St. Louis Childrens Hospital in a great hurry. When he arrived it was found that he was moribund from loss of blood. When an attempt was made to introduce an esophagoscope to investigate the bleeding, the hypopharynx and esophagus were filled with old blood which promptly filled up the esophagoscope. This method of examination was abandoned in favor of an incision in the neck at the level of the pin over the great vessels. When the neck was opened a large triangular tear in the internal jugular vein was found. By this time the child was dead. Evidently the eyelet of the stomach tube had caught the keeper as it was being withdrawn and had pulled the point of the pin through the wall of the esophagus and the tissues of the cervical region including the internal jugular vein.

CASE 2.—J. M., age 3½ years, was admitted to St. Louis Childrens Hospital Feb. 6, 1935, with complaint of being unable to swallow solid foods for a year. In 1934, he had had a choking spell on Thanksgiving day. The foreign body was discovered accidentally: a dentist, in the course of x-raying the child's teeth, fluoroscoped his chest to amuse his little sister and discovered the safety-pin. X-ray showed an open safety pin in the esophagus with the point up and to the right. Apparently the pin was long enough to perforate the esophageal wall and the films showed a shadow at this point which was interpreted as an abscess. Esophagoscopy was done on the day of admission. There was granulation tissue around the shaft of the pin on the point side. It was dislodged and allowed to enter the stomach. We left it in the stomach rather than risk breaking up the protective barrier which we felt sure had been formed by this time around the original site of the pin. The child vomited during the first postoperative night and, when fluoroscoped on the following day, the safety pin was found to be back in the esophagus with the point down. Esophagoscopy was done and the pin was easily removed by pulling it up into the esophagoscope. At the time of the second esophagoscopy a small stream of bloody pus coming from the site of impaction was readily visible. The patient was discharged in good condition.

CASE 3.—B. L. L., age 2 years, was admitted to the St. Louis Childrens Hospital on Nov. 16, 1937, with the history of having swallowed an open safety-pin at 10:30 a. m. on the day of admission. She had no respiratory difficulty, no coughing and no wheezing. X-ray showed an open safety-pin in the esophagus with the point up and to the left at lower third of the esophagus. The safety-pin was removed by endo-gastric version under fluoroscopic guidance. She was discharged in good condition.

CASE 4.—D. M., age 13 months, was admitted to the St. Louis Childrens Hospital with a history of having swallowed an open safety-pin about three days previously. She had been reasonably comfortable since the accident, with very slight cough, no vomiting and regular breathing. She had not eaten solid food for three days but had been taking fluids well. X-ray showed an open safety-pin in the esophagus at the region of the cricopharyngeus with the point up and to the left. No pneumothorax was present. Esophagoscopy was done. The pin was grasped and the point was engaged and brought into the end of the scope and the outward journey started. It was lost just as it was about to come out of the cricopharyngeus. It was then picked up just above the cardia and removed by endogastric version under fluoroscopic guidance. The patient was discharged in good condition.

CASE 5.—G. H., age 2 years, was admitted to St. Louis Childrens Hospital July 21, 1936. The child had been well until four weeks previously when he had what was considered a common cold and then developed lobar pneumonia on the left side. Then the right side supposedly became involved. The child was thought to be developing fluid and an x-ray film was taken and a safety pin located in the esophagus. For a week prior to admission he had had respiratory difficulty. On admission temperature was 103.1, pulse rate 140, respiration 28. He was cyanotic and his breathing was shallow. X-ray films showed a large open safety pin in the esophagus, with the point up, just below the bifurcation of the trachea. There was pneumothorax on the right side and possibly on the left. The pin was removed on July 22 by endogastric version and there was an odor of gas which was noted as soon as the esophagoscope

was introduced. The esophagus was filled with pus and gas. The child did not do well and on the following day closed drainage for empyema was done with recovery of well over 500 c.c. of pus. The patient died several days later. Autopsy showed scarring of the esophageal surface at the level of the bifurcation of the trachea, pneumonic involvement of the right lower lobe, right empyema with drainage, fresh thrombi in the pulmonary artery to both lower lobes and metastatic abscess in the right axilla.

REFERENCE

1. Jackson, Chevalier: Bronchoscopy, Esophagoscopy and Gastroscopy, Philadelphia and London: W. B. Saunders Co., 1934.

THE USE OF SILK SUTURES FOR ABDOMINAL WOUNDS

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SUFFICIENT interest in silk sutures has been shown recently to warrant a detailed description of their preparation and use. Interrupted sutures of fine silk can be used with advantage almost anywhere in the body. The neurologic and ophthalmic surgeons have used them as buried sutures for many years. They are becoming increasingly popular in operations upon the thyroid and for hernias and the recent study of disruption of abdominal wounds has shown the advisability of their more extensive use in abdominal surgery.

No attempt will be made here to enumerate the merits and demerits of buried silk as suture material. That it has both, its advocates are ready to admit. The question of its superiority or inferiority to catgut for suturing abdominal wounds has been adequately covered in a number of recent papers. That fine silk when properly used excites very little reaction and that it can be safely buried in tissues has been shown experimentally and clinically many times. It is probably not advisable to use it in the mucosa of the kidney, ureter, bladder or common bile duct as it may subsequently act as a nucleus for formation of stone.

An essential for good results from silk sutures is a surgical technic as aseptic as possible with injury to the tissues reduced to the absolute minimum. Halsted in experiments upon dogs showed that the likelihood of bacteria growing in wounds is materially increased when injured or necrotic tissue is present. It is doubtful if many surgeons today have such uniformly successful healing of wounds as did Halsted for few are willing to devote equal care and time to wounds.

The silk generally used is No. A and No. C manufactured by Belding-Hemingway and Company. It is black in color and is the same material commonly used by tailors, dressmakers, and shoemakers. It is purchased in one ounce spools and ordinarily sells for $1.00 an ounce. The A silk is fine in texture and the C silk is slightly heavier. When occasion demands either one may be used double though this is seldom necessary.

Sufficient silk for an abdominal operation is wound upon a board 8 inches long. The board and silk are then autoclaved or boiled with the other supplies and instruments. After the nurses' table is set up for the operation the surgical nurse rubs sterile unadulterated

beeswax over the silk. The wax strengthens the silk, makes it easier to handle, and lessens its capillarity. The sutures are then cut in any length desired, 16 inches being the one most frequently employed. For emergency purposes silk wound upon small pieces of cardboard is kept sterile and on hand at all times. These small cards are wound with silk, placed in a jar containing wax and the jar with contents autoclaved. These are then ready for use in the emergency room or for supplementing the supply prepared for large operations.

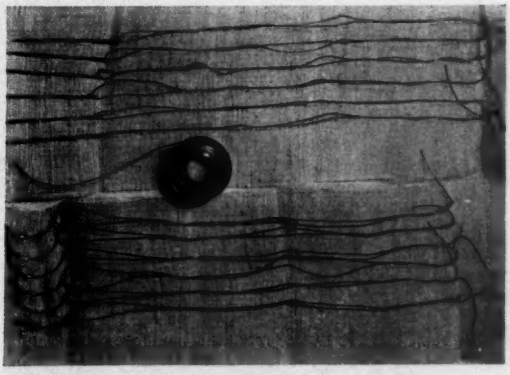

Fig. 1. Needles and sutures threaded upon gauze strips. Halsted spool wound with "C" silk.

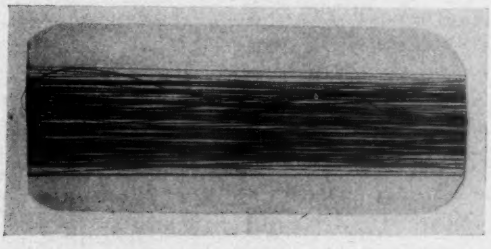

Fig. 2. "A" silk wound upon board 8 inches long. The wax is rubbed into the silk which is then cut into desired lengths.

In using silk smaller needles are used than is customary with catgut. A curved cutting No. 13 and straight cutting No. 11 are satisfactory for most operations. Only for operations upon tiny structures are any other needles necessary. Many surgeons who use silk employ the round needles but I find the cutting ones so much easier to use that I routinely use them. A sharp knife causes less destruction of tissue than a dull one and I believe that a sharp needle which pulls through easily causes less reaction than one which does not go through tissue so readily.

Being small the needles are difficult to thread so the self-threading eye is a distinct help. They may be obtained from Berbecker of New York. Fifteen of each type of needle are threaded by the nurse before the operation commences. Unless the operator is unusually rapid or the nurse slow, with this number as a start the nurse will always be ready with a threaded needle.

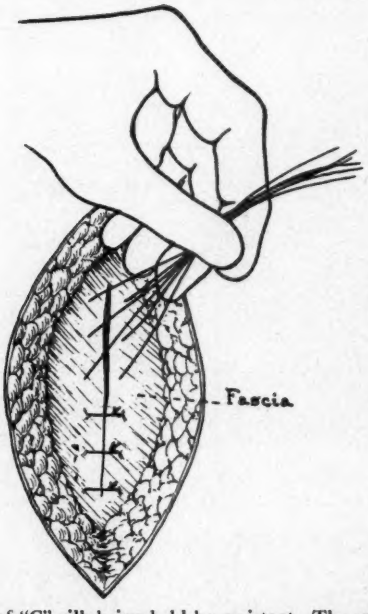

Fig. 3. Fascial sutures of "C" silk being held by assistant. The sutures are usually cut closely to the knot, even more so than shown here.

The technic of using silk for intraperitoneal suturing will not be described for once the principle of using silk is mastered it may be used as previously stated almost anywhere in the body. Silk is so fine that it is never necessary to use it "swedged" to the needle.

The peritoneum is sutured with a continuous suture of single strand No. C which is usually 32 inches long. The fascia is sutured with interrupted sutures of single strand No. C. As the sutures are placed beginning at the superior angle of the wound, the assistant holds them until all are placed. The surgeon then ties each one beginning at the inferior angle. By placing all before tying, time is saved and more accurate approximation with more evenly divided tension upon each suture is possible. Each suture is tied three times and cut closely to the knot. Divided blood vessels are ligated with the A silk. The Halsted glass spools with the silk wound upon them

serve to expedite the placing of ligatures. They are also cut closely to the knot.

The skin is sutured with interrupted sutures of single strand No. A. If so desired a few sutures may be placed in the subcutaneous fascia or buried sutures with the knot turned inward may be placed in the deep layer of the skin. By using them fewer cutaneous sutures are necessary. It is thought by some that the subcutaneous

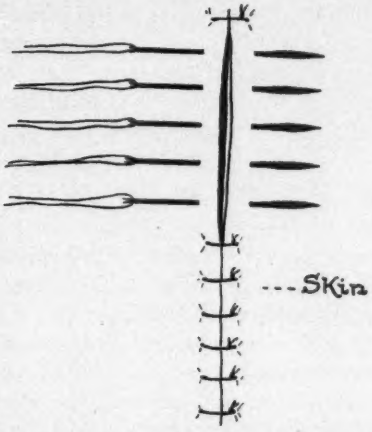

Fig. 4. Interrupted suture of "A" silk in the skin. Each needle is drawn through separately by the assistant. Tractor sutures at each end have been tied and cut.

sutures prevent stretching or widening of the scar but it is doubtful if they aid materially in doing so. The use of subcutaneous sutures and buried sutures in the deep layer of the skin do permit earlier removal of the cutaneous sutures. After an extensive trial of them I have largely abandoned their use as too time consuming.

Straight needles with A silk are used for suturing the skin. A suture is placed and tied at each end of the wound. The ends are left long and used as tractors which straighten the incision and help to prevent puckering. The needles are inserted through both edges of the wound but not pulled through until all of them have been placed. Leaving the needles in place splints the incision and permits the edges to be approximated with less tension than when each suture is tied immediately after placing. With the aid of a small hemostat and beginning with the last needle, the assistant pulls the needles completely through as the surgeon ties the sutures. The wound may be dressed with silver foil, vaseline gauze or saline gauze. When subcutaneous sutures are used, the cutaneous sutures are removed on the fifth to the seventh postoperative day. Otherwise they are removed on the seventh to the tenth day.

HYPERTENSION AND ITS SURGICAL TREATMENT

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THE clinical condition recognized as hypertension or sustained elevation of the blood pressure is not necessarily a serious malady, and yet under certain conditions it may become progressive and in spite of all types of medical treatment may terminate fatally. Operations on the sympathetic nervous system have been devised to augment medical therapeutic measures in these more serious types of hypertension, and these operations have been carried out in a sufficient number of cases to prove their efficacy, safety and logicalness.

One hundred and thirty-six patients with hypertension have been operated on in the Section on Neurologic Surgery at The Mayo Clinic, using subdiaphragmatic extensive sympathectomy, without an operative death and with only four subsequent deaths. Clinical improvement after operation varied according to the progress of the disease, the age of the patient, and the amount of vascular, cardiac and renal damage. Suitable preoperative tests have been devised to measure the amount of potential physiologic response to sympathetic denervation, and these tests have prevented unsuccessful operations and indicated those cases in which would follow a sufficient lowering of the blood pressure or relief of clinical symptoms to make operation justifiable.

Hypertension may be classified into two general types. In most cases it is of the type designated as "primary" or "essential" hypertension, that is, the increase in blood pressure cannot be attributed to any known disease. Secondary hypertension is that which results from known diseases.

Three factors are responsible for the maintenance of the blood pressure: the cardiac output, the viscosity of the blood, and the peripheral arterial resistance. In essential hypertension, the cardiac output and the viscosity of the blood are normal in uncomplicated cases, but it is recognized that there is increased peripheral arterial resistance. In essential hypertension there is an abnormal response of the arterioles to stimuli, and there may be a marked fluctuation in blood pressure, emotion or cold increasing it greatly. This shows a fluctuant state of tonus of the arterioles. Whether the increased resistance offered by the arterioles results from abnormal vasomotor

Read before the meeting of the Virginia State Medical Society, Roanoke, Oct. 12, 1937.

impulses which are received from the brain, or whether the arterioles react abnormally to normal stimuli transmitted through the sympathetic nervous system, is not important. There is some evidence that there are no abnormal vasomotor stimuli in essential hypertension; hence, it must be assumed that the arterioles react excessively to normal vasomotor stimuli.

The present conception of hypertension in relation to surgery is based on the fact that there are two factors in the elevation of blood pressure in hypertension: (1) the inherent condition of the arterioles, and (2) an abnormal reaction of the arterioles to vasoconstricting and vasodilating impulses. In cases of hypertension in which there are wide fluctuations in blood pressure, the chief cause of elevation of the blood pressure may be an abnormal response of the arterioles to vasomotor stimuli. When the blood pressure is high and fluctuates little, it is probable that the inherent or automatic function of the arterioles is dominant. This automatic function of the arterioles may result, in part, from organic changes which exist in increasing degree as the severity of the hypertension increases. In most cases of gradually progressive hypertension, the inherent arteriolar function gradually replaces the vasomotor factor. Repeated observations on patients who have been operated on for hypertension have shown that, when the blood pressure fluctuates widely and at times reaches low levels, operation (that is, interruption of vasomotor impulses) is most beneficial, whereas when the blood pressure is fixed at high levels, surgical treatment is ordinarily of little value.

Essential hypertension may be divided into four groups as follows: Group 1 consists of cases in which there is a slight increase in blood pressure, which ordinarily becomes normal as a result of rest. Mild sclerosis of the retinal arteries is present. Group 2 includes cases in which there is moderate to severe hypertension, moderate sclerosis of the retinal arteries, and occasionally venous thrombosis and arteriosclerotic retinitis. Group 3 includes cases in which patients suffer from moderate to severe hypertension and in which a definite angiospastic retinitis is found. Group 4 includes cases in which patients have a very severe hypertension associated with an angiospastic retinitis and edema of the optic disks. This is not an entirely satisfactory classification because it fails to indicate the importance of the rapidity of progression of the disease. Moreover, in an individual case, the hypertension is not always found to belong in the same group; hypertension which was once classified as being of group 1 may have to be classified later in group 2 or 3. As a working basis, however, the classification is fairly satisfactory, since the seriousness of hypertension ordinarily increases progressively as the number of the group into which it is classified increases.

Medical treatment of essential hypertension of group 1 is usually satisfactory. Severe hypertension (group 4) does not respond satisfactorily to medical treatment, but the patients must be cared for. Some patients who have hypertension of group 2 or 3 respond fairly well to medical treatment. A period of several days' rest in bed, during which time the blood pressure is determined several times a day, frequently produces a decrease in blood pressure and convinces the patient of the value of rest. If the patient is obese, his weight should be reduced; if he is not obese, a general diet may be employed. Were there available a nontoxic adequate vasodilator, the problem of the treatment of many patients with essential hypertension would be fairly satisfactorily solved. Unfortunately, no such substance is available. The nitrites, acetylcholine and acetyl-beta-methylcholine have in common a vasodilating action which is too short to be very valuable. Careful studies of the effect of bismuth subnitrate administered by mouth have shown little or no effect on the blood pressure. At present, also, there is no clear evidence that hormones obtained from the ovaries are of any value, and restriction of salt and protein is not now considered to be effective in the treatment of essential hypertension. There is some evidence that potassium thiocyanate may be effective, but the dosage must be carefully regulated. Sedatives, and particularly the barbiturates, are most valuable drugs in the treatment of hypertension. Under controlled conditions, it can be demonstrated that the administration of large amounts of sedatives will cause the blood pressure to return to normal in many cases of hypertension. The amount of sedative drug to be given, three or four times a day, should be great enough to abolish nervousness and restlessness and yet small enough to avoid drowsiness and excessively slowed mental reactions. The physician who sees many cases of essential hypertension, however, will be impressed by the fact that many of the patients do not respond adequately to medical treatment. It is for some of this group of patients that surgical treatment is being used.

The purpose of the surgical treatment of essential hypertension is to bring about the prolonged vasodilatation that follows elimination of the vasoconstrictor stimuli to certain parts of the arterial system. These stimuli can be reduced by employing different types of operation. Among the earliest operations employed were bilateral lumbar sympathetic ganglionectomy and trunk resection and cervicothoracic sympathetic ganglionectomy. These procedures were not effective in materially lowering the blood pressure, however, since they were limited in scope. A more extensive form of sympathectomy consisted of ventral rhizotomy, including section of the ventral roots of the spinal cord from the sixth thoracic to the second lumbar. This pro-

cedure interrupted the efferent sympathetic fibers which pass through these roots and carry vasoconstrictor impulses and thus denervated approximately the entire vascular area below the diaphragm. A reservoir was then created in the denervated vascular area when the undenervated vessels went into spasm. In addition, thorough denervation of the suprarenal glands was accomplished by interrupting the sympathetic fibers before they entered the capsules of the glands, eliminating the central influence in producing excessive secretion of epinephrine under emotional stress. Also, thorough denervation of the arteries supplying the kidneys should increase circulation in the kidneys and aid in the elimination of metabolic products which, if present and retained as a result of disease of the kidneys, might perhaps produce pressor effects on the arterial tonus. Inclusion of all of the ventral roots, from the sixth thoracic to the second lumbar, inclusive, was designed to interrupt all the efferent fibers from the thoracolumbar sympathetic outflow below the fifth thoracic segment, since no efferent sympathetic fibers leave the spinal cord below the second lumbar spinal roots.

Subsequent to extensive section of the ventral roots, both the systolic and diastolic blood pressures of some patients remained at lower levels than before and the symptoms of hypertension were relieved. This allowed for numerous studies to be made, and it was possible to alter the surgical technic in order to reduce the magnitude of the operative procedure and to develop less hazardous measures which might be effective in lowering blood pressure. It was then discovered that the best surgical results were obtained when the operation was extensive and a large vascular area was denervated. This was true also of sympathectomy in other diseases, such as Raynaud's disease and thrombo-angiitis obliterans; the most complete and permanent results were obtained only when denervation of the involved arteries had been effected.

Since laminectomy and rhizotomy was a rather formidable procedure, and since section of the splanchnic nerves alone proved to be inadequate in relieving hypertension, resection of all three splanchnic nerves, with a portion of the celiac ganglion and complete removal of the first and second lumbar ganglions on each side through a subdiaphragmatic approach, was finally adopted. In addition, in a rather large series of cases resection of a third to a half of each suprarenal gland was carried out. This operation was divided into two stages, an interval of ten days elapsing between operations on the right and the left sides, respectively. Subdiaphragmatic extensive sympathectomy is greater in scope and interrupts more thoroughly the efferent fibers from the thoracolumbar sympathetic outflow than the supradiaphragmatic operation. Because of some

question as to the value of suprarenal resection, a series of patients has been operated on without this procedure and, because the effect of the operation was of little consequence, the suprarenal glands are no longer being resected but are palpated in every case to exclude the possibility of tumors.

It is useless to perform extensive sympathectomy on patients with hypertension who have suffered irreparable damage to the cardiovascular mechanism; nor should it be advised in cases in which the patients have a mild and slowly progressive form of the disease which is amenable to medical treatment. The patient for surgery must be an individual who has a definite vasospastic type of hypertension, one who experiences sharp and brisk rises in blood pressure when the hands are immersed in cold water and one who has a marked fall in blood pressure when given pentothal sodium, amytal or nitrites. As an average rule the patient must be less than 50 years of age and be classed as having a hypertension of group 2 or 3 in respect to the severity of symptoms. The so-called cold test is carried out by determining the blood pressure, with the patient resting, until it reaches a basal level. A hand is then immersed to the wrist in water at 4 degrees C. for one minute and the blood pressure is determined at the end respectively of 30 seconds and 1 minute of immersion. The highest value is considered characteristic of the response. The response of the blood pressure to this test is a measure of the way in which it responds on innumerable occasions to such stimuli as anxiety, fright, and mental stresses and strains. In cases in which operation has produced a significant decrease in blood pressure, the systolic blood pressure responds less sharply to the test than does the diastolic pressure.

Operation is advised only for patients whose blood pressure responds satisfactorily before operation to the following standard tests: (1) the slow and intermittent intravenous injection of a 5 per cent solution of pentothal sodium until there is no further drop in the blood pressure; ordinarily 500 mg. to 1 Gm. is injected; (2) the administration of 3 grains (0.2 Gm.) of sodium amytal each hour for three successive hours; (3) the administration of ½ grain (0.032 Gm.) of sodium nitrite at half-hour intervals until six doses have been given, and (4) hourly determinations of blood pressure during rest and sleep for a minimum of twenty-four consecutive hours.

If the blood pressure decreases to normal or to nearly normal as a result of all these measures, the patient may be considered a satisfactory candidate for operation. If the response of the blood pressure to these measures is inadequate, the effect of operation is

almost certain to be unsatisfactory. Unfortunately, even when these tests indicate that the results of operation should be satisfactory, the actual results obtained will not necessarily be as good as the tests indicate. In other words, in spite of a satisfactory response of the blood pressure to tests before operation, there is a considerable chance that the blood pressure will not be reduced significantly by operation. We have made it a practice at the clinic to accept for operation only patients whose hypertension has been progressive in spite of medical supervision. We wish to emphasize, however, that in almost every case of essential hypertension there is a period during which operation may be a valuable therapeutic procedure and a period during which operation will almost certainly be valueless. Hence, if patients with essential hypertension are to be operated on, operation must be performed before the blood pressure becomes relatively fixed at high levels.

Contraindications to operation are as follows: an age greater than 50 years, congestive heart failure, angina pectoris, marked renal insufficiency and advanced arteriosclerosis. We do not consider spasm and apparent sclerosis of the retinal arteries, retinitis, moderate enlargement of the heart, inversion of T waves in the electrocardiogram, albuminuria, and a slight reduction in renal function or a cerebrovascular accident from which recovery has been satisfactory, contraindications in themselves.

In carrying out extensive sympathectomy, the incision employed and the position of the patient on the operating table are similar to those employed for exploration of the kidney, except that the upper portion of the wound is carried high enough to incise the oblique fibers of the latissimus dorsi muscle, exposing the twelfth rib. The incision is extended downward and outward over Petit's triangle, exposing the capsule of the perinephric fat. Periosteal resection of the twelfth rib is then done, care being taken not to injure the pleura. The subcostal ligament of the twelfth rib is then incised, allowing upward retraction of the intercostal vessels and nerves and affording better exposure of the splanchnic nerves and lumbar ganglions. The liver is displaced forward and downward as well as the capsule of perinephric fat. At this point, a salt laparotomy sponge is inserted to protect the peritoneum and its contents which is being dissected from the underlying muscles. Gentle dissection with moist cotton-ball sponges reveals, first, a splanchnic trunk composed of major, minor, and lesser splanchnic nerves descending from above downward between the crura of the diaphragm. These nerves are about 2 cm. in length and end in the celiac ganglion; resection includes the greater portion of the ganglion with the splanchnic nerves. The first and second lumbar sympathetic

ganglions are exposed as they lie along the mesial border of the psoas muscle, and they are removed with the intervening trunk in order to interrupt fibers that pass downward in the lower end of the sympathetic trunk as well as to interrupt white rami carrying efferent impulses to the upper two sympathetic lumbar ganglions. In this manner the splanchnic vessels, the suprarenal glands, and the kidneys are denervated. The muscular fascial planes are approximated with continuous and interrupted sutures of chromic catgut and the skin is closed with silk.

Following splanchnic resection and removal of lumbar ganglions the sweating function of the feet and lower part of the legs is lost. The cutaneous temperature is definitely increased and continues to remain so permanently. There is paralysis of the ejaculatory powers, and of the muscles of the urogenital trigon similar to that following neurectomy applied to the presacral nerves. The menstrual cycle is not altered, and the childbearing functions of the female are not changed. Sterility of the male does result although, fortunately, potentia and libido are not disturbed. While this extensive sympathectomy deprives the small and large bowel and the ureters and bladder of sympathetic innervation, it does not appear to increase the frequency or urgency of urinary or fecal evacuation. Curiously enough, the atonic bowel, the dilated colon which so frequently troubles constipated people, and Hirschsprung's disease are definitely improved by this operation since section of the sympathetic fibers to the bowel results in a decrease of inhibitory stimuli. The same applies to the muscular mechanism of the ureters and bladder.

Two definite phenomena in the cardiovascular mechanism develop following this operation. The first is a fall in blood pressure when patients first get out of bed and stand in the erect position, and the development of tachycardia. The first can be relieved with a tight binder and, the second, by the patient's accommodating himself to decreased exertion.

The effect of the operation on symptoms, while variable, is roughly proportional to the effect on blood pressure. However, patients not infrequently note relief of headache, fatigue, pain in the chest, "dizziness" and nervousness in spite of the fact that the blood pressure has not been greatly reduced by operation. It is probable that some of the symptoms associated with hypertension, such as headache, may occur only when the pressure reaches an excessively high level. Operation which may reduce blood pressure only slightly may lower it enough so that some of the symptoms do not occur. There seems no other logical explanation for the observation that, in many instances, relief of symptoms is much more

marked than the reduction of blood pressure. In most instances in which the blood pressure has been greatly reduced by operation, headache is relieved, pain in the chest disappears, fatigue is lessened and the patient gains weight and in general feels greatly improved. Many of them note diminution of nervousness and of a "let down" feeling, which gratifies them. Some patients have said that they feel "entirely well," or "better than in several years." In general, about 70 per cent of the patients who are operated on are benefited clinically. Some patients whose blood pressure has been greatly reduced by operation continue to note undue fatigue, weakness and dyspnea for weeks or months after operation. One of our patients whose condition was followed closely did not regain normal strength until about six months after the operation. We have not been able to determine definitely that the patients who notice these symptoms following operation are those who continue to have orthostatic hypotension, but it appears that this is so.

Summary

Most patients who have hypertension of group 1 do not require surgical treatment. Surgical treatment is advisable for patients who have hypertension of group 2 or 3 if the hypertension is known to be progressive, if the function of the heart and kidneys is good, and if the value for the blood pressure becomes normal or approximately normal as a result of rest or sleep, or following the intravenous injection of pentothal sodium, or following the administration of sodium amytal or the nitrites. Hypertension, group 4, does not respond satisfactorily to surgical treatment.

It should be borne in mind that hypertension is not ordinarily static but fluctuant in degree. At the Clinic, our preoperative studies consist of at least twenty-four consecutive, hourly determinations of the values for the blood pressure so that we can determine the maximal blood pressure, the minimal blood pressure and the mean or average blood pressure. Postoperative studies are of the same type when patients are re-examined at the clinic. When the family physician examines the patient at our request, he sends us a minimum of three determinations of the blood pressure taken at intervals of five minutes. It is only in this way that it is possible to obtain a true picture of the condition. The response of the blood pressure to immersion of the hand in ice water gives important information, as it indicates the degree of increase of the blood pressure following other stimuli, such as fright, anger, and nervous tension.

It is apparent that operation for essential hypertension can be carried out without undue risk, that patients are not disabled as a result of operation and that the blood pressure of many of them is

significantly reduced by operation. Other patients note amelioration or relief of symptoms even when their blood pressures have not been significantly reduced. This does not allow the conclusion that operation may be considered a cure for essential hypertension, for operation does not reduce the blood pressure in many instances in which the disease is advanced and in which an increased blood pressure may perhaps result from irreversible changes in the kidney. The periods of observation which have elapsed since operation do not allow us to make statements relative to the permanency of good results. We do, however, feel that the results have been sufficiently encouraging to justify further use of this method of treating selected cases of progressive essential hypertension.

A SIMPLIFIED FRACTURE FRAME

FRED F. RUDDER, M. D.

Atlanta

An effort has been made to overcome the bulkiness and inefficiency of existing fracture frames. Frames of the type shown in the accompanying photograph have been used satisfactorily in the treatment of fracture by traction of both upper and lower extremities for the past six years.

The advantages of this type of frame are:

1. It is fixed to the bed diagonally in order to be in the line of pull of traction.

2. It is constructed of ordinary ¾ inch water pipe.

3. It can be made by any blacksmith.

4. With proper "U" bolts it can be fitted to any type of hospital bed.

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SHOCK OR PERIPHERAL CIRCULATORY FAILURE

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SHOCK is an all-inclusive term which denotes a disturbance in the circulation that is characterized by a diminution in the venous return of blood to the heart. This holds true in general because the heart itself is not at fault and is able to propel the blood that returns to it. The diminution in the venous return results usually from a decrease in the ratio of the volume of blood in circulation to the capacity of the vascular tree, due to a decrease in the volume of circulating blood or to an increase in the capacity of the vascular bed or to both. The mechanism of the production of all types of shock is not the same. Just as there are many causes of fever and as there are different varieties of heart failure, so there are various mechanisms which result in shock as the end product. For example, many different factors in varying degrees may enter into the production of shock that is associated with operations. Among these may be included anesthesia, hemorrhage, loss of plasma from exposed surfaces, loss of water by sweating, dilatation of vessels as a result of mechanical irritation and vascular reflexes, infection and the disease for which the operation is performed. Much of the confusion in regard to shock arises from the tendency of many interested in the subject to attempt to explain by one mechanism all instances of the condition. This is due in part at least to the fact that relatively uncomplicated types of shock can be produced in experimental animals whereas mixed types are seen most often in patients. One tremendous difference lies in the fact that experiments are usually performed on normal animals whereas operations are frequently performed on ill patients. The percentage of the blood volume that it is necessary to remove in order to produce shock in a normal animal may be quite out of proportion to the loss of blood that results in shock in an individual in poor condition.

All physicians are well acquainted with the clinical picture that is presented by most patients in shock. It is characterized by pale and sweating skin, cold extremities, feeble pulse and collapsed veins. This group of findings may be encountered under a variety of circumstances; following extensive burns, trauma, operation, internal or external hemorrhage, following the perforation of a hollow

From the Department of Surgery of Vanderbilt University. Aided by a Grant to Vanderbilt University from the Division of Medical Sciences of the Rockefeller Foundation.

Read before the Postgraduate Surgical Assembly, the ninth annual meeting of The Southeastern Surgical Congress, Louisville, March 7, 8 and 9, 1938.

viscus, complicating the infectious fevers, associated with continued vomiting or diarrhea, in acute pancreatitis, in pulmonary embolism, in heat stroke and in many other conditions. Whereas heart failure is characterized by overfilling of much of the vascular bed, shock or peripheral circulatory failure is associated with collapsed veins due to underfilling. The central problem in the study of shock should be centered upon determining the agencies responsible for the decrease in the venous return to the heart, for the decrease in the circulating blood volume and for the collapsed veins and low venous pressure. As has been stated, the condition as presented in patients is usually quite complicated and the various factors cannot be measured quantitatively. For these reasons, shock has been studied in experiments on animals in which as many complicating factors as possible have been eliminated.

The method chosen in some of our earlier studies was similar to that employed by Cannon and Bayliss[1] in which one of the posterior extremities of the anesthetized cat was traumatized by striking it with a hammer. This method is of advantage in that the opposite normal extremity can be used as a control. Cannon and Bayliss found that there was not sufficient bleeding into the traumatized area to account by itself for the reduction in the blood pressure and it was assumed that the continued fall in pressure following trauma was produced by the absorption of some depressant substance. Earlier observations which will not be enumerated prompted Parsons and Phemister[2] and myself[3] to repeat the experiments of Cannon and Bayliss which contributed the main evidence for the toxemia theory. Injury was produced by striking one of the posterior extremities of anesthetized dogs many blows with a hammer. It was observed that the swelling which followed the injury was not limited to the area directly traumatized but extended into the loose tissues of the groin and flank. Cannon and Bayliss performed their amputations by symmetrical cuts across the upper thighs in the studies in which they determined the local loss of fluid into the injured part. Hence, it seemed that these amputations had not been performed at sufficiently high levels if the entire loss of fluid was to be determined. In both my experiments and those of Parsons and Phemister, the amputations were performed above the site to which the swelling extended, and the difference in the weights of the injured and non-injured parts was determined. This difference indicated the loss of approximately one half of the total blood volume into the injured area and a comparison with experiments in which death was produced by uncomplicated hemorrhage showed that it was sufficiently great by itself to account for the decline in blood pressure. Similar results were obtained under ether, barbital and spinal anesthetics.

Many other experiments of different types were performed. One[4] of these consisted of burning the greater part of one half of the body surface of deeply anesthetized animals. This results in the escape of blood plasma into the injured tissues. The quantity of this fluid was determined roughly by weighing the injured and non-injured parts of the body. A comparison with the effects of plasmapheresis showed that the decrease in blood volume as a result of the loss of plasma into the injured tissue spaces was sufficient to account for the decline in blood pressure in burns of approximately 20 hours duration. There was a marked increase in the concentration of the blood. It is of particular importance that the fluid lost into the tissue spaces has the same protein content as blood plasma because protein is the constituent that maintains to a large degree the osmotic pressure in the blood vessels. It seems likely that tannic acid, for example, may exert its beneficial effects in burns by reducing the loss of blood plasma as well as by cutting down on the absorption of toxins. In this connection, it is of interest that Underhill, Kapsinow and Fisk[5] found that absorption from a burned area is much slower than it is under normal conditions.

It is rather generally believed that hemorrhage and shock are quite different phenomena. Shock associated with gross trauma to tissues is frequently accompanied by an increase in the concentration of the blood, by no favorable response to transfusion and by capillary congestion and hemorrhage in the tissue. Uncomplicated hemorrhage from a large vessel is usually accompanied by a dilution of the red blood cells, by a favorable response to transfusion if the bleeding is stopped, and by an anemic appearance of the tissues. That the findings in shock due to trauma and to hemorrhage are not necessarily different is shown by the following observations. Experiments[6] were performed on dogs under local anesthesia in which the blood pressure was gradually reduced to a low level by the slow withdrawal of blood from the femoral artery. An attempt was made to maintain the blood pressure at a low level as long as possible preceding death. An increase in the concentration of the red blood cells occurred in a few of the experiments. Capillary congestion and hemorrhage were noted in some of the organs at autopsy. A low blood pressure of longer duration was produced in other experiments in which the pressure was reduced by the removal of blood from the femoral artery and death was delayed by the introduction of blood by the direct method from a suitable donor. In this way, the blood pressure was kept at a low level for several hours before death occurred. All of the animals died despite the fact that more blood was introduced than was removed. An increase in the concentration of the red blood cells occurred and capillary congestion and hemor-

rhage were present in many of the tissues. The important point is that hemorrhage alone may present the same findings as shock due to trauma if the blood pressure remains at a low level for a considerable time preceding death. The reason that these findings are not observed in patients who succumb to uncomplicated hemorrhage is that death follows rather rapidly in most instances without a prolonged period of low blood pressure. On the other hand, if the bleeding is controlled, the blood pressure rises as a result of vasoconstriction and the withdrawal of fluid from the tissue spaces into the blood stream or the artificial introduction of fluids. On the contrary, in shock due to trauma when blood is lost from many small vessels into the tissue spaces of the injured part, the decline in the blood pressure is slower and the duration of the low pressure is longer because the speed with which the fluid escapes is governed largely by the number and size of the vessels and by the relationship between the pressure in the blood vessels and in the tissue spaces. If death occurs, it has usually been preceded by a low blood pressure for a considerable time and the changes which have been described take place. The fact will be commented upon later that the same significance cannot be attached to all declines in blood pressure. For example, a decline in blood pressure following an operation on the brain in which there has been little loss of blood is not of as grave concern as a decline in blood pressure associated with a marked diminution in the blood volume due to blood loss associated with trauma. A decline in pressure of much longer duration may be recovered from in the former condition.

Evidence as to the mechanism of the production of different types of shock was obtained in experiments[7] in which the output of the heart and the blood pressure were determined frequently during its development. The slow withdrawal of blood was associated with an early decline in the output of the heart and a subsequent decline in the blood pressure. Trauma to an extremity was followed by similar alterations. On the other hand, the injection of histamine was associated with an early decline in the blood pressure and a subsequent diminution in the cardiac output. The same was true of primary shock, the condition associated with the injection of an excessive amount of procaine in the spinal canal[8] and bilateral adrenalectomy. A similar division of these different types of shock was obtained by Roome, Keith and Phemister[9] in experiments in which the bleeding volume after various procedures was determined. As a result of these and other experiments, I have attempted a classification[10] of peripheral circulatory failure from a physiologic viewpoint.

The terms that are used to designate the different types are hematogenic, neurogenic and vasogenic. The hematogenic type refers to those instances where there is an initial decrease in blood volume which is followed by vasoconstriction and a decrease in the cardiac output and subsequently there is a decline in the blood pressure. The conditions associated with hemorrhage and trauma to muscles are examples of this type. As the primary factor at fault is a decline in the blood volume, treatment should be directed towards restoring it by introducing fluids, preferably blood. The neurogenic type is associated with vasodilatation which is dependent on diminished constrictor tone as a result of influences acting through the nervous system. The blood pressure declines first and there is a subsequent diminution in the blood volume and cardiac output. Primary shock and the condition resulting from excessive spinal anesthesia are examples of this type. Vasoconstrictor drugs are frequently of aid in the treatment of this type. In the vasogenic type, there is vasodilatation which is produced by agencies which act directly on the vessels. Histamine probably exerts the major portion of its effect in this manner. As has been stated, most instances of shock in man are complicated and may be combinations of the different types.

As has been stated, the diminution in the return of blood to the heart in shock results from a decrease in the ratio of the volume of blood in active circulation to the capacity of the vascular bed, due to a decrease in the volume of blood or to an increase in the vascular bed or to both. In an effort to overcome this disproportion, one has a choice of two methods of therapy. One of these consists of augmenting the blood volume by introducing fluids into the blood stream or in a location where they may be absorbed. The second consists of the use of vasoconstrictor drugs in an effort to diminish the capacity of the vascular system.

Of these two methods of treating shock, those directed towards augmenting the blood volume are of more value in far the greater number of cases. Patients in shock rarely can take fluids by mouth and it is necessary to give them elsewhere. It is our feeling that given a choice, fluids should be administered elsewhere than directly into the veins. However, in fully developed shock, fluids given per rectum or into the subcutaneous tissues will be absorbed slowly if at all. Hence, it is frequently necessary to administer them intravenously. Of the various fluids, blood is the most valuable in most instances of shock. By the use of blood, the blood volume is not only increased and is more apt to remain increased, but the oxygen carrying power is enhanced as well. This is particularly important when hemorrhage to the outside or into the tissues has been a factor in the production of shock. When there is an increase in the concentra-

tion of the blood due to a loss of plasma in the main rather than red blood cells, the ideal fluid for intravenous injection is blood plasma. Among other things, this aids in maintaining the osmotic pressure in the blood stream which is not true of solutions of crystalloids. However, these latter solutions are frequently of great aid in the treatment of shock and even more so in preventing it. The intravenous infusion should be given slowly except in grave emergencies. Hypertonic solutions are used by many with the idea of increasing the blood volume by osmotically drawing fluid from the tissues into the blood stream. The wisdom of this is questionable because the solution leaves the blood stream rapidly and in addition, in many instances of shock, the tissues are already dehydrated.

In association with Beard, Wilson and Weinstein[11], the effects on the blood volume and protein content of the plasma of injecting the various fluids used in treating shock were studied. Large quantities of fluid were injected intravenously into animals in which gross injury to capillaries had been produced. Briefly, it was found that the injection of large quantities of fluid resulted not only in a loss of most of this fluid from the blood stream but also in a marked dilution of the protein of the plasma remaining in the circulation. Thus it would seem that it is distinctly possible to do harm by very large infusions particularly if they are given rapidly. One of the advantages of whole blood or blood plasma is that protein is present and a dilution of the protein of the plasma of the blood stream will not occur. These points are mentioned not as an objection to the use of salt or glucose solutions for intravenous use but simply as a warning against the injection of excessive amounts.

Vasoconstrictor drugs are rarely of aid in the treatment of shock. They result in a temporary rise in blood pressure but it is seldom maintained except in primary shock. The aim in hematogenic shock should be to increase the blood volume. Vasoconstriction is already present and further constriction does little if any good.

The best treatment of shock is prevention. After the blood pressure remains at a low level for a long time, marked damage to the capillaries occurs and even red blood cells can escape through them. Fortunately, the incidence of shock associated with operations has declined markedly due to better hemostasis, the gentle handling of tissues, advances in anesthesia and other factors. Patients should be supplied with ample fluids prior to operation except in very grave emergencies. Vigorous catharsis should be avoided. Fluids should be administered during the operation if it is a protracted one. Maddock and Coller[12] have pointed out the great fluid loss during and after operations. They found that the sick surgical patient needs

2000 c.c. of water to replace that lost by vaporization, 1500 c.c. for the formation of urine, and additional quantities if vomiting and diarrhea are present. A patient who was particularly dehydrated before operation should be given even larger quantities.

In summary, the pathogenesis and treatment of shock have been considered. It has been emphasized that the mechanism of the production of all types of shock is not the same and they cannot all be satisfactorily explained by one theory. Such attempts result only in confusion.

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THE AMBULATORY TREATMENT OF FRACTURES OF THE LOWER EXTREMITY

R. Arnold Griswold, M. D., F. A. C. S.

Louisville

AMBULATORY treatment of fractures of the lower extremity denotes a method which allows the patient to walk and bear weight on the injured limb.

The advantages of such a method may be tabulated as follows:

1. Hospitalization is held to a minimum. This is important for economic and other reasons.

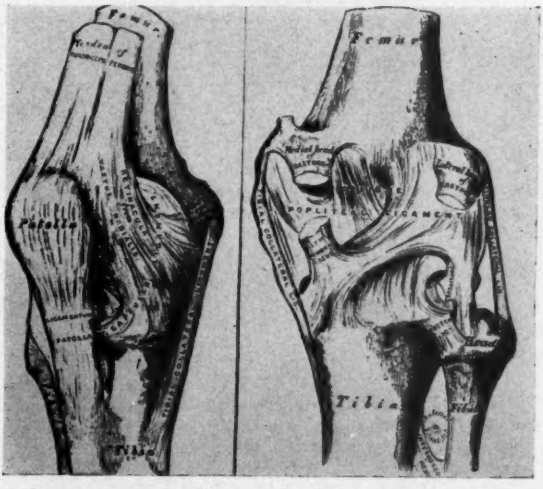

Fig. 1. Drawing, after Gray, showing muscle attachments about the knee. Contraction of the quadriceps with each step transmits motion to the entire anterior capsule through the retinaculae, the patella and the patellar ligament. Posteriorly motion is transmitted to the capsule through slips from the semimembranosus, gastrocnemius and popliteus. This motion prevents agglutination of muscles, tendons, fascial planes and the synovia, without disturbing the relationship of the bones.

2. The patient can take care of himself and can often go about his ordinary occupation during the period of healing of the fracture.

3. The beneficial psychologic effect of transforming an injured patient with a broken leg into a well man with a plaster bandage on his leg cannot be overestimated, and is almost a specific preventive of compensation neuroses.

4. Use of the extremity hastens union because of a slight intermittent pressure on the fragments with each step. This principle has been used for years in the familiar treatment of delayed

union by daily grinding of the fractured surfaces together or by repeated percussion on the sole of the foot as practiced by Rechtman and others. Ambulatory treatment applies these beneficial procedures to the fresh fracture.

Fig. 2. Boot cast and walking iron applied for fractures about the ankle.

5. Perhaps the most important advantage of ambulatory treatment is the effect on soft parts of the injured limb. A fracture is an injury not only of bone but also of muscles, fascia, nerves, vessels and even skin. Normal final function of these structures is just as important as the restoration of physical continuity of the bone. Everyone is familiar with the stiff joints, weak, atrophic muscles and edematous subcutaneous tissues which follow fractures, especially when treated by conventional means of immobilization. Active use of the extremity including weight bearing during the healing period largely obviates these undesirable results. Muscles, tendons and fascial planes actively slide over each other with each step, preventing the gluing together of these structures. Exercise maintains muscular strength and prevents wasting. The active pumping effect of contracting and relaxing muscles sustains normal blood supply to all tissues. Even in the joints which are immobilized, the capsule and synovia undergo motion from the contraction of the muscular slips which originate and insert in them. (Fig. 1.) This results in a minimum of joint stiffness.

The first requirement of this method of treatment is accurate anatomic reduction of fragments. This may be accomplished in most cases by the conventional means familiar to all surgeons. The second requirement is the application of a retention dressing which will maintain the corrected position under the strain of weight bearing until healing is complete. This is best accomplished by the use of the non-padded plaster cast as described by Boehler, Schnek,

Fig. 3. Thigh cast and iron, applied with or without incorporated pins for fractures of the leg.

Gurd and others. For fractures of the os calcis, condyles of the knee, and shaft of the femur, as well as comminuted or displaced oblique fractures of the tibia and fibula, skeletal fixation is necessary to prevent displacement. This is provided by steel pins which transfix the bones proximal and distal to the fracture and which are firmly incorporated in the cast. Adequate methods and appliances for skeletal reduction and fixation of these more difficult fractures have been described by Boehler, Anderson, myself and others.

Four types of casts are used for fractures of the lower extremities: (1) the knee length boot for injuries about and distal to the ankle; (2) the upper thigh cast for fractures of the shafts to the bones of the leg; (3) the groin (Thomas caliper type) cast for fractures about the knee; (4) the spica for fractures of the femur. The basis of all these casts is longitudinal anterior and posterior

plaster splints which are covered by circular plaster bandages. The splints must be soft and wet enough to mold themselves accurately to the contours of the limb, especially over the bony prominences. The anterior plaster must extend to the base of the toes to prevent edema on the dorsum of the foot such as occurs distal to an improperly applied elastic bandage. At the upper edge of the cast is a single layer of flannel to prevent irritation from the sharp edge of the plaster. The boot cast extends to the top of the tibial tubercle

Fig. 4. Groin cast with padded ring for fractures of the upper end of the tibia.

in front and is closely molded to the heads of the tibia and fibula to transmit part of the stress of weight bearing. It is trimmed behind just enough to permit 90 degree flexion at the knee. (Fig. 2.)

Higher casts are applied with the knee extended (not hyperextended). The thigh cast extends to the upper third of the thigh. The upper portion of this cast should be applied snugly enough to prevent motion at the knee and friction over the patella (Fig. 3). The groin cast and spica contain a padded ring similar to the ring of a Thomas caliper splint to transfer part of the stress of weight bearing to the ischium (Fig. 4). For the spica the trunk is covered with stockinette or flannel and the bony prominences of the pelvis with light padding to prevent friction. The walking iron is not applied for 24 hours. This allows the cast to harden sufficiently so that no dent will be caused by the iron. With such casts and proper

skeletal fixation most fractures of the lower extremity, even including some of the shaft of the femur, may be made ambulatory (Fig. 5).

The greatest objection to non-padded casts in the minds of those unaccustomed to their use is misapprehension regarding circulatory disturbances from swelling. This fear is largely unfounded. No encircling cast, whether padded or non-padded, should be applied early in the presence of severe soft tissue damage without immediate division of the cast throughout its entire length. If this is necessary, the edges can later be coated with another layer of circular plaster after swelling has subsided.

Fig. 5. Spica cast with incorporated pins for fractures of the femur. This patient also has a fracture of the tibia and fibula.

Swelling, however, even in severe injuries can usually be controlled by proper treatment. The first principle is that the best way to prevent and reduce swelling is to reduce the fracture. There should be little place in modern surgery for the custom of waiting for swelling to go down before reducing the fracture. The second and equally important principle is the proper elevation of the extremity both before and immediately after the reduction of the fracture. Perhaps the most important practice is careful, intelligent observation for 48 hours after the application of the cast. The signs of circulatory obstruction as observed in the toes are: (1) swelling, (2) cyanosis,

(3) impaired sensation, and (4) impaired motion. Swelling and cyanosis may be treated by elevation and observation, but anesthesia of the digits even to the extent of inability to localize touch accurately on the toes, and inability to wiggle the toes are imperative indications for splitting the cast throughout its entire length.

The surgeon who is a beginner in the non-padded technic, even though he has had much experience with padded casts, probably should not start on acute fractures. His first efforts should be practiced on fractures of the foot and ankle which have been treated by other means and in which the ambulatory cast may be used as a convalescent brace. This will relieve the operator of maintaining reduction and of the fear of swelling. When such patients can bear weight immediately after application of the cast and walking iron without pain or bad effects the surgeon may graduate to the field of acute fractures and more extensive casts.

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The Southern Surgeon

Published Bi-monthly by

The SOUTHERN SURGEON PUBLISHING COMPANY

701 Hurt Building

ATLANTA

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Subscription in the United States, $4.00

VOLUME VII APRIL, 1938 NUMBER 2

ADDRESS

It is my pleasing duty, as the representative of the profession of the city and state, to bid you welcome to our metropolis. In the light of the excellence of your past meetings and of the splendid program of interesting subjects and of distinguished speakers which has been prepared for this session my task becomes one of privilege and ease. The fact that your eminent President hails from our State is an added incentive to us, his local confreres, to extend to you our fraternal greetings and to place at your disposal for work, for pleasure and for diversion such means as are at our command.

One cannot but be impressed by the numbers attending such a meeting as this having as their sole objective the acquirement and the diffusion of surgical knowledge. Devoid of social and political features the Congress offers but one attraction, the opportunity to present and discuss the newer ideas and concepts in surgical practice and to crystallize opinion and judgment in evaluating methods of treatment which have been tested in the crucible of experience.

The medical profession is the only body solely responsible for the acquisition and dissemination of medical and surgical information. Its most valuable asset is the constantly accumulating fund of knowledge stored in the minds and the literature of its members. This knowledge is made freely available to its members and to the public and while possessing definite and concrete value it does not fit into the capitalistic concept of economics. It is interesting to note that

NOTE: The foregoing, delivered by Dr. Abell at the opening of the Louisville meeting, is much more than an address of welcome. It so well expresses some of the ideals of the medical profession and it so well explains the reason for the existence of The Southeastern Surgical Congress that, even if it came from one less distinguished than the President-Elect of the American Medical Association, it would be worthy of preservation. EDITOR.

exclusive of the various units comprising the American Medical Association there are approximately 300 medical societies in the country, indicating the sincerity and earnestness of the medical profession in keeping abreast of the ever advancing wedge of current medical knowledge. It is also a matter of interest that notwithstanding the reduction in the number of medical schools with an increase in and prolongation of the courses of instruction there has been no decrease in the number of graduates from that which obtained under the old regime of instruction at the beginning of the century. With the absorption of foreign born doctors and of Americans graduating in other countries the number of men entering practice each year is 1,500 to 1,800 greater than the deaths and retirements, showing that medicine still holds its lure as a profession. A student upon entering medical school assumes a certain obligation to the profession since without the mass of information amassed by the latter there would be no fund of knowledge available for his education. When he makes use of this in fitting himself for practice he enters into an implied agreement to contribute, after graduation, to the common capital from which all may draw. The doctor who declines to participate in the activities of medical societies does himself and his profession an injustice in that he refuses to do his part in increasing the common fund while still profiting by the use of it. Men attending such meetings as this do so not with any idea of financial gain but with the aim of improving their ability to render better medical service. They find their reward in a consciousness of service, in the approval of their confreres, in the gratification of their own scientific curiosity and in the satisfaction that comes from taking a part in the accretion and diffusion of medical learning.

It is of particular interest to note, that with the exception of the Clinical Congress of the College of Surgeons, the Southeastern Surgical Congress is the only organization of its kind devoted exclusively to the consideration of subjects and problems pertaining to surgery. The growth and development in the art and science of surgery during the present century has been unprecedented: its accumulation has been so rapid and extensive as to upset all previous conceptions both as to its acquisition and distribution. The graduate who has not kept abreast of the current finds himself woefully lacking in the newer knowledge and procedures with a consequent failure in understanding of their principles, application and usefulness. Surgical practice to be good must embrace the constantly accumulating fund of knowledge accruing from study, from research, from clinical experience and investigation and from scientific evaluation of all that is proposed for its advancement. The newer

knowledge, thoughts and concepts meeting these requirements are so great that graduate study and education has forged to the front as one of the important problems confronting the profession today. As a consequence meetings such as this fill a very definite want and place in presenting a cross section of existing surgical thought and practice.

Kentucky has a history rich in medical and surgical attainment: the medical schools of Transylvania and Louisville Universities reach back beyond the century mark; the rosters of their teachers contain the names of many who have gained positions of professional eminence. McDowell, Dudley, Drake, Bradford, Gross, Flint, Yandell, Mathews, McMurtry are but household words with us and are equally known to you, their contributions having been faithfully inscribed on the scroll of time. We, their professional descendants, looking forward with eager and pleasing anticipation to the message which you bring, feel highly honored in having you as our guests: we extend to you a most cordial welcome and beg of you to consider us at your service during your stay in our midst.

IRVIN ABELL, M. D.

POSTGRADUATE SURGICAL EDUCATION

The academic student who closes his books at commencement with the idea that his education is completed, in later years will find himself lost in the onward procession of knowledge and culture. How much more is this true of the medical student in a science which progresses so rapidly!

At the time of the War between the States the requirements leading to the M. D. degree were often met during one session. With the advance in knowledge since that time a boy could acquire only a smattering of medical knowledge in a year: indeed he hardly lays his eyes on a patient for two years and of course he can't learn to diagnose and treat all diseases in two more. The internship which is now almost universal in this country is already required in several States before the M. D. is bestowed. Before a man should be allowed to invade the body of his fellow he should have much longer and more thorough training. The American Board of Surgery is a step for the protection of the public, which is a step in the right direction.

Postgraduate training therefore demands serious thought and action. Individual members of the profession choose various satisfactory means of keeping abreast of the times as by attendance at large clinics. Study abroad is not regarded as so essential as in

former times, except in the prestige it may afford. Ample opportunities are afforded on this side of the water.

It should be the function of the medical schools to teach postgraduate as well as undergraduate medicine, and institutions suitably located and equipped are filling the need admirably. Laboratory methods must be taught in this manner. Such courses, however, entail considerable time and expense, and are not available to the average practitioner. If feasible, therefore, other ways of imparting postgraduate insruction should be developed.

The prime purpose of The Southeastern Surgical Congress is postgraduate education, and this organization is credited with being the first to inaugurate an exclusively surgical postgraduate assembly. The success of the plan is shown by the remarkable attendance of more than a thousand doctors at the recent meeting in Louisville. Organization of a "Faculty" is contemplated in the near future. This "Faculty" will be largely responsible for the set-up and management of the program.

Another new departure is being sponsored by the Congress, one which gives promise of great success in carrying postgraduate instruction to the doctor in smaller towns and rural districts. One or more assemblies are to be held in every State during the year, the choice of location being a small town hospital, which will provide patients for clinical discussion. Georgia, Florida and South Carolina have been putting on such programs for several years with most encouraging results. The surgeons are thus enabled to demonstrate the volume and character of work they are doing, and valuable information is brought right to the door of every practitioner. The supervision of this movement also is to be allotted to the proposed Faculty.

The officials of the Congress believe that the small assemblies in small towns will prove a blessing to many doctors who cannot attend meetings far from home. It has been noted that members of the profession are present at these meetings who are never seen at any other kind of medical gathering. The Executive Committees in the other seven States in our territory should give the plan a trial. Surgeons and lay groups operating hospitals throughout the Southeast are eager to be included in the program.

FRANK K. BOLAND, M. D.

THE REVIEW OF TUMOR THERAPY

About a year ago *The Review of Tumor Therapy* was founded in Charleston in order that oncologists might have their own organ. It was ambitious to start a new medical journal without the backing of a substantial parent organization: new medical journals just don't spring Minerva-like from an active brain particularly during a Roosevelt Recession. In order therefore not to disappoint the subscribers to the Review, its Editors approached THE SOUTHERN SURGEON with a view to continuing publication as a section of this journal.

The true surgeon is interested in the best possible treatment of tumors. He is convinced that this is radical removal, but unfortunately this is not always possible. It has long since been proved, for example, that the most successful way to handle carcinoma of the cervix uteri is with radium. X-ray, in the opinion of some, is the treatment of choice in certain types of breast cancer. All surgeons call on the radiologist for help in some cases. By that same token, the man primarily interested in radium and x-ray must also be deeply interested in the work of him who uses a scalpel.

The term "tumor therapy" includes the use of the cold steel knife, the endotherm, radium, x-ray and every other method that may be used by experienced, reputable men in the treatment of tumors, benign or malignant.

There can be no quarrel between men who wish to treat properly carcinoma and other neoplasms. THE SOUTHERN SURGEON therefore welcomes to her covers her younger sister in the belief that the subscribers to both journals will profit.

THE POSTGRADUATE SURGICAL ASSEMBLY IN LOUISVILLE

An act of God made it impossible for The Southeastern Surgical Congress to hold its eighth annual meeting in Louisville last year but at that time Dr. Abell asked for a "rain-check." Having had an extra year to perfect its arrangements, the doctors in Louisville staged on March 7, 8 and 9 the most successful meeting the Congress has ever held. More than a thousand doctors attended, including large delegations from Ohio, Indiana and Illinois, as well as, of course, representatives from the ten States making up the Congress. If these men are consulted, another early meeting in Louisville can only be prevented by another act of God.

Dr. Elmer L. Henderson was the General Chairman of the Assembly and to him more than to any other one man is due the success of the meeting. Dr. Dan Y. Sage was again Chairman of the Program Committee and it would appear that his success in arranging programs has assured him this job for life. Dr. Edgar G. Ballenger was Director of the Radio Programs that were broadcast during the meeting. Dr. R. Arnold Griswold, the Chairman of the Louisville Radio Committee, with Dr. Abell and Dr. Charles M. Edelen, not only arranged for the time on the air during the meeting but also did splendid work advertising the meeting in advance. Dr. W. O. Johnson was Chairman of the Auditorium and Exhibits Committee: the technical details of the auditorium were handled perfectly thanks to him and his Committee. Dr. Irvin Abell was Chairman of the Entertainment Committee. Dr. W. B. Owen headed the Hotel Committee. An account of the Assembly would not be complete without tribute to this committee and to the management of the Brown Hotel who were constantly on the alert to see that everything ran as smoothly as possible. Dr. J. B. Lukins headed the Publicity Committee which not only succeeded in securing the largest registration the Assembly has ever had through their preliminary advertising but they also secured splendid cooperation from the *Courier-Journal* and the *Louisville Times* in the accounts of the meeting. Dr. A. T. McCormack and Dr. D. P. Hall respectively headed the Reception and Transportation Committees. Miss Grace Stroud, President of the Jefferson County Medical Auxiliary, was Chairman of the Ladies' Entertainment Committee and the wives who went to Louisville are all eager to go back.

The Assembly was opened at 9 on the morning of Monday, March 7 by the President, Dr. Fred W. Rankin. The Rev. H. W. Tribble of the Southern Baptist Seminary pronounced the invocation. Dr. Irvin Abell made a most gracious address of welcome in which he emphasized that a doctor's education is never complete and that The Southeastern Surgical Congress was offering excellent postgraduate training to the surgeons of this section. This address is published elsewhere in this issue.

The program was run off as already announced except that Dr. William B. MacNider was unable to be present and Dr. V. K. Hart of Charlotte substituted for him.

Monday afternoon the business meeting of the Fellows of the Congress was held. At this meeting it was decided that in keeping with the spirit of the times greater emphasis should be laid on the fact that the annual meeting was essentially a postgraduate surgical assembly in order to encourage the attendance of surgeons who are not Fellows of the Congress. Emphasis was also laid on the meetings which had been staged in the smaller towns of Georgia, Flor-

ida and South Carolina, between the regular Assemblies. At this time Dr. R. L. Sanders, of Memphis, was made President-Elect and Dr. Elmer L. Henderson, of Louisville, Vice President. Dr. T. C. Davison, of Atlanta, who was chosen President-Elect at the meeting in Charlotte last year, succeeded to the Presidency automatically at the close of the Congress. Atlanta was selected for the 1939 Postgraduate Surgical Assembly. Following the business session the Jefferson County Medical Society held an informal reception. Dr. C. C. Howard, Dr. Elmer L. Henderson, Dr. J. Duffy Hancock, and Dr. G. A. Hendon entertained the speakers and the officers at dinner.

Monday evening at 8 p. m. the Congress held a joint meeting with the Jefferson County Medical Society in honor of the late C. Jeff Miller. Dr. J. Duffy Hancock, President of the County Society, presided at this meeting. Dr. Rankin delivered the Presidential Address, "Modern Trends in the Practice and Teaching of Surgery" at this meeting. Dr. Alton Ochsner presented the C. Jeff Miller lecture. Both of these addresses will be published in these pages.

Tuesday evening the annual banquet was held in the ballroom of the Brown Hotel. A floor show was provided by the orchestra and entertainers from the Blue Grass Room. The incomparable William D. Haggard presided as toastmaster. Dr. Irvin Abell, Dr. Fred W. Rankin, Dr. A. T. McCormack, Dr. G. A. Hendon, Dr. B. T. Beasley, Dr. T. C. Davison and others spoke briefly. After the speeches an informal dance was staged for the entertainment of the doctors and their wives. This was graced by some young ladies from Kentucky and their fame needs no comment here.

There were only two clinics on the program this year, Dr. A. E. Hertzler, speaking on prolapse of the uterus and Dr. Haggard on surgery of the gallbladder.

The round table lunches were particularly well attended on Monday and Tuesday and at these meetings there were stimulating discussions. On Wednesday the round table meeting was omitted in order to save time and when the formal meeting adjourned at 4:30 more than 150 men were still present.

The Atlanta Fellows of the Congress realize that they will have their hands full to equal the show put on by the Louisville doctors, but, sharing none of the violet's virtues, they invite all and sundry to be their judges. Indeed they have already taken off their coats and gone to work.

BOOK REVIEWS

The Editors of THE SOUTHERN SURGEON *will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

PRACTICAL PROCTOLOGY. By LOUIS A. BUIE, A.B., M.D., F.A.C.S., Head of Section on Proctology, The Mayo Clinic; Professor of Proctology, The Mayo Foundation for Medical Education and Research, Graduate School, University of Minnesota. 512 pages, with 152 illustrations. Price, $6.50. Philadelphia and London: W. B. Saunders Company, 1937.

Buie's new book is written with charming informality and it makes good reading. He never leaves you in any doubt as to his ideas in the subjects discussed. The book is unquestionably of value and it is well illustrated.

The author is singularly unenthusiastic about the injection treatment of hemorrhoids. His description of his treatment of pruritus ani is rather terrifying: one wonders why he does not revert more closely to the method originally suggested by Harvey Stone, whose name, by the way, does not appear in the bibliography. The chapter on ulcerative colitis is stimulating. The chapters on diverticula and polypoid disease of the colon are also fine. In the chapter on cancer he cites a series of more than 100 cases in which the carcinoma was fulgurated through the proctoscope. Of these patients, one died of metastases more than eight years later, two were apparently well after six years and one apparently well after eight years. This method of treatment however is not often applicable and in the majority of cases in which used was not so successful.

Dr. Buie writes as an intense individualist and those who wish to know his opinions and practices will find them clearly set forth in this book. However, the beginner might be warned that Dr. Buie is not the only proctologist whose opinions and methods are worthy of respect in these United States.

CHEMISTRY OF THE BRAIN. By IRVINE H. PAGE, A.B. (Chem.), M.D., Hospital of The Rockefeller Institute for Medical Research, New York. 444 pages. Price, $7.50. Springfield and Baltimore: Charles C Thomas, Publisher, 1937.

The reviewer's lot, like the policeman's, is not always a happy one. The reviewer has to go over some books that cause him to wonder why they were published and he has to go over others so rapidly that he is unable adequately to study them. The present book is an example of the latter class.

Dr. Page has presented a comprehensive review of the chemistry of the brain with an extensive bibliography. The book is a most successful "attempt at orientation in this field." He has taken the trouble to write well. In spots this scholarly book is a little deep for the general reader but it is always interesting and it contains a great deal of clinical value.

His discussion of the various narcotics and anesthetics is particularly valuable to the clinician and the chapter beginning with the effect of diet and vitamin deficiency on the nervous system is superb. Not every practitioner will be required to purchase this book, but the pathologist and the neurologist should own it and the rest of us would be better off for having access to it for reference.

OPERATIVE GYNECOLOGY. By HARRY STURGEON CROSSEN, M. D., Professor Emeritus of Clinical Gynecology, Washington University School of Medicine; Gynecologist to the Barnes Hospital, St. Louis Maternity Hospital, and St. Luke's Hospital; Consulting Gynecologist to De Paul Hospital and to the Jewish Hospital; and ROBERT JAMES CROSSEN, M. D., Assistant Professor of Clinical Gynecology and Obstetrics, Washington University School of Medicine; Assistant Gynecologist and Obstetrician to the Barnes Hospital and the St. Louis Maternity Hospital; Gynecologist to St. Luke's Hospital and to the De Paul Hospital. Fifth edition, entirely revised and reset. 1076 pages with 1264 illustrations including 3 color plates. Price, $12.50. St. Louis: The C. V. Mosby Company, 1938.

For 23 years a standard text, the fifth edition of this work was necessary on account of the unusual activity in searching out the fundamental principles of gynecologic physiology, during the past seven years. The book has been practically rewritten, and about two hundred new illustrations have been added.

One is tempted to credit to Dr. H. S. Crossen the thoroughness, clarity and mature judgment and to his son the freshness, spontaneity and enthusiasm everywhere apparent. Whether this division of the credit is correct or not, it is a very wonderful book.

ARTIFICIAL FEVER. *Produced by Physical Means: Its Development and Application.* By CLARENCE A. NEYMANN, M. D., F. R. S. M.; Associate Professor of Psychiatry, Northwestern University Medical School; Honorary Professor of Medicine, National University of Mexico; C. R. B. Exchange Professor of Universities of Ghent, Liege, Louvain and Brussels, Belgium. 294 pages with 68 illustrations. Springfield and Baltimore: Charles C Thomas, Publisher, 1937.

Artificial fever just now, as the author notes, is "undoubtedly the vogue." Neymann discusses the preparation of the patient and the technic: he gallantly admits that in his earlier investigations disaster resulted from his inexperience in three cases. He is most anxious that others should profit by his misfortunes.

Fever therapy is an invaluable adjunct in the treatment of late syphilis. Alone it will not cure early syphilis, but it seems that it is here too a most valuable aid, as Ballenger has also showed. Fever therapy again is of tremendous value in gonorrhea especially in conjunction with sulfanilamide, though Neymann does not advise it as the routine method in early, uncomplicated cases. Fever has, of course, been used in many other conditions—too often without rationale or result. Neymann believes that the indications and contraindications are being satisfactorily worked out, but one should study the book to find out what these are.

In short, the physician who has patients he thinks might benefit from thermotherapy should study this book.

Review *of* Neoplasms

formerly

The Review of Tumor Therapy

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THE SURGERY OF CARCINOMA OF THE STOMACH

During the past few years a number of reports have been made on the end results of gastric carcinoma. Certain aspects of the published figures lend a ray of hope that the present high mortality of this disease, which is estimated to cause 38,000 deaths in the United States yearly, can be appreciably reduced.

Cancer of the stomach is curable in its early stages. Balfour has reported from the Mayo Clinic 48 per cent five-year survivals of cases in which regional lymph node metastases were absent and the growth confined to the stomach wall. Gatewood reported 46.1 per cent five-year cures on recovered cases. Such figures compare favorably with the percentage of cures for cancer elsewhere in the body.

Unfortunately the diagnosis of cancer of the stomach is not often made in this early stage. The percentage of operability averages about 25 per cent. In some clinics it may be as high as 50 per cent. In rural communities the figure may be as low as 5 per cent (Foss). But many of the resected cases show local extension. When involvement of the regional lymph nodes has occurred the chance of cure by resection is markedly diminished. In the Mayo Clinic series it is 18 per cent compared to 48 per cent when neoplasm is entirely intragastric.

Total five-year survivals after resection vary between 10 and 50 per cent of recovered cases. Most figures are about 20 per cent (Anschuetz 20 per cent, St. John 21 per cent; Lewisohn and Mage 20 per cent; Eggers 33 per cent). Therefore of 100 persons in whom a diagnosis of cancer of the stomach is made today about 25 are not too advanced for resection and 5 of them may expect at a 5 year cure. Not an imposing record to be sure! But reports from clinics where more cases are being diagnosed in the earlier stages demonstrate that these figures can be improved.

The key to earlier diagnosis would seem to be for both patient and practitioner to be more impressed by vague gastric complaints in a person of cancer age. The peak of incidence is about 55 years

of age, but 10 per cent of cases occur before the age of 40. Collins reports that patients with cancer of the stomach diagnosed in the Cleveland Clinic have had symptoms on the average between 6 and 12 months. He suggests that careful examination after one month of symptoms should increase the chances of early diagnosis.

The chief means of early diagnosis today is roentgenologic. However, the gastroscope also is coming into wider use. To what extent the gastroscope may supplement the x-ray in early recognition of cancer remains for the future to decide. At the present time, however, radiologic examination is the most accurate and practicable method in general use.

It is of no less importance to have an x-ray examination of the stomach for vague gastric complaints than to secure roentgenograms of the chest in suspected pulmonary tuberculosis. The indications for referring a patient for x-ray study of the stomach should be extended, for the symptomatology of early cancer is most meager. While reports are at hand of failure of the x-ray to reveal early malignancy, these cases are the exception rather than the rule. In 1000 consecutive x-ray examination of the stomach Beilin found 7.1 per cent to have cancer.

With earlier diagnosis the operative mortality after gastric resection for carcinoma should become lower. Already the mortality of gastric resection for ulcer is around 5 per cent in the hands of those performing large numbers of these operations. For a carcinoma confined to the gastric wall the figure should not be much higher. In more advanced cases the operative mortality will probably continue to be high. The results of palliative procedures, such as gastrojejunostomy, have proved in general, disappointing. Anschuetz reported a mortality of 36 per cent and an average survival period of only 6 months after palliative gastroenterostomy. Maingot and others have advised exclusion of the pylorus with a Polya anastomosis on non-resectable cases in which the growth is confined to the pyloric region. The chief purpose of this procedure is to prevent the subsequent occlusion of the stoma by extension of the growth.

Some attempt has been made to use radiation therapy in gastric carcinoma. Merritt reported 13 cases treated by Coutard's method with 3 surviving. Kaplan suggests radon seeds implanted at operation followed by radium pack. Eloesser has used massive doses of x-ray through the open wound combined with cautery excision. No large series of cases followed for a sufficient length of time are at present available properly to evaluate the end results of radiation. Resection, when feasible, is the procedure of choice in all cases. No

extended studies are available of the possibility that irradiation as an adjunct to surgery may increase the percentage of cures or lengthen the average survival period.

Cancer of the stomach is a curable disease in its early stages. Painstaking examination, including roentgenographic studies, are indicated in all patients over 40 who complain of vague epigastric symptoms lasting more than one month.

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CLINICAL ONCOLOGY, AN OPPORTUNITY FOR THE PATHOLOGIST

There is a professional and lay campaign well under way to acquaint individuals with the common early manifestations of cancer and to impress upon them the importance of immediate medical consultation when such symptoms and signs appear. The medical profession must meet the growing public demand for the prompt diagnosis and treatment of patients who either have or are fearful of having a neoplasm. In most instances the family physician will have to decide what cases require further consultation.

The usual consultants will be the pathologist, the radiologist, and the surgeon. Each has his own concepts and technics, but it is impractical for any one to work without the advice of the others. This discussion is concerned with the opportunities and responsibilities of the pathologist.

The period of laboratory seclusion is passed, and the pathologist can no longer discharge his duties by merely turning out anatomic diagnoses. The science can no longer be accurately designated morbid anatomy, even though its basis remains the determination of structural alterations. A pathologist is expected to explain clinical evidence of functional abnormalities in disease on an anatomic basis. He is constantly thinking of alterations in structure in terms of abnormal physiology and biologic chemistry, and in addition he must consider the influence of bacteriologic, biologic, immunologic and physical factors. Pathologists, therefore, consider that the preclinical and the clinical medical sciences converge at the pathologic laboratory and the autopsy room.

In the past particularly, some pathologists have not seen fit to share this broad viewpoint of disease with the clinician. The tumor clinic now offers such an opportunity. There, in company with the roentgenologist and the surgeon, the pathologist should examine the patients and he should discuss with the other members of the group the best course to pursue in the diagnosis and treatment of each case. That the pathologist is not concerned personally with any therapeutic technic is to his advantage, because he is not led unconsciously by his specialty to champion one form of therapy over another and he can adopt more easily a disinterested viewpoint.

In pathology, more than in any other specialty, the workers inevitably meet with the study of tumors. This is true particularly of the hospital pathologist who has a surgical pathology service, but his responsibility no longer ends when he has confirmed or altered a clinical opinion regarding the presence of malignant disease. When he diagnoses cancer he should indicate the usual course of the type of tumor represented by the specimen and its probable behavior in the case under consideration. The ability to form such judgments requires long experience and expressions of opinion should be guarded and based upon more than morphologic considerations. Frequently the clinical aspects of a case will alter the pathologic opinion. Pathologic terminology and expressions of degrees of malignancy and susceptibility to irradiation of tumors are misinterpreted frequently. This is partly because pathologic reports are usually based upon the tendency of tumors as types and, while these scientific opinions are sound, the course of a particular neoplasm in an individual patient may be altered tremendously by such factors as the duration of the growth, its local extent, its location and the possibility of surgical removal, the general state of the patient, and the sensitivity of the patient's skin to irradiation.

Where better than in the tumor clinic can these different factors be estimated and correlated to the advantage of the patient and the

consultants? The smaller hospitals will have to depend upon the services of diagnostic pathologic laboratories, but even there the pathologist, through carefully composed reports, can give the local clinicians and radiologists the benefit of his experience. Under those circumstances it is especially necessary that the pathologist be supplied with all of the relevant clinical data on the cases.

Furthermore, the tumor clinic gives to the pathologist the opportunity for cumulative understanding of the natural history of tumors through the study of individual cases throughout their whole course, and not infrequently there is the opportunity to autopsy the fatal cases. Only by such methods will sound, applicable knowledge of tumors be acquired.

The organization of a tumor clinic is largely a local problem, but where a pathologist of the proper temperament and experience is available it is probable that he can assume, with advantage to all, the initiative of organization and the responsibility of direction, because the radiologist and surgeon are burdened already with the responsibility of clinic direction. Experience has proved already that the responsibility for the disposition of the patients should be placed in the hands of the radiologist, the surgeon, and the pathologist as a group.

The tumor clinic, therefore, represents a growing opportunity for the pathologist to increase his services to the profession and to humanity. For those who are not impressed with idealogic considerations, service in the tumor clinic offers adequate returns from the standpoint of professional and economic self interest. The present trend toward establishing new hospitals and enlarging existing institutions will mean more and better positions for pathologists. Those highly trained in oncology will more easily obtain the most remunerative positions.

HAROLD WOOD, M. D.

THE SIGNIFICANCE OF HEREDITY IN THE ETIOLOGY OF CANCER

More light has been thrown upon the nature of cancer in the past 30 years than in all other periods of history combined. New knowledge has been derived not only from clinical studies, but also from an ever-widening experimental field opened up by the discovery of a susceptibility to tumors in certain animals. Agents suspected from clinical studies of playing a causative role in the etiology of cancer in man have been evaluated in the experimental animal under controlled conditions. The clinical evidence accumulated tends to indicate that the facts derived from animal experiments are in large part applicable also to the problem of cancer in man.

Thus far no single underlying cause has been found adequate to explain the occurrence of malignant disease in man or animals. On the contrary the indications are that cancer may be caused by a number of different agencies. Experimentally cancer may be produced by simple transfer of a portion of a malignant tumor from one animal to another, by protracted local stimulation of tissue growth, or through selective breeding in susceptible animals.

Studies of the transplantation of cancer in animals have served chiefly to emphasize the specific nature of malignant diseases. Transplantation of cells or filtrates of tumors is more successful among susceptible animals of the same family. The transplants frequently fail to grow in unrelated animals of the same species, and cannot be carried from one species to another. From these findings the inference is drawn that favorable metabolic conditions are also an essential factor in the development of cancer.

Investigations of induced cancer in animals are confirmative of the age-old belief that prolonged irritation is causative of cancer. In susceptible animals, cancer may be produced at will by the topical application of such widely divergent physical and chemical agencies as x-ray radiation, animal parasites, coal-tar derivatives, dyes, etc. Long-continued stimulation of tissue growth by these agents induces malignant new growth in tissues of old and young animals with almost equal facility. However, there is a definite variation in the time necessary for the induction of cancer among animals with different hereditary backgrounds even in the same species.

Studies by geneticists have produced convincing proof of the hereditary transmission in animals of a susceptibility to cancer. Through selective breeding almost 100 per cent of a strain of animals may be rendered susceptible to spontaneous cancer. The findings of Slye[1] and other geneticists indicate that hereditary susceptibility to cancer is transmitted in animals as a recessive Mendelian

character. Apparently there are recessive units for each of the different forms of malignancy, i. e. one for carcinoma, another for sarcoma, etc. Thus, a susceptibility to specific malignant change in particular tissues of the body is transmitted. Moreover, each of the recessive units are subject to suppression by a dominant allelomorph so that it is also possible by selective breeding to produce cancer resistant, as well as susceptible strains of animals in the same species. The resistant strains are not only immune to spontaneous neoplastic disease but are said to be refractory to the induction of cancer by the carcinogenic agents discussed above. It is noteworthy that the occurrence of spontaneous cancer in susceptible strains is affected by the duration of life of the animals, in that early death from other disease of course reduces the total incidence of cancer.

Much of the evidence from animal experimentation is readily acceptable when translated into terms of the practical problem of human cancer. The part played by protracted stimulation of tissue growth is clearly exemplified by numerous external cancers. The conditions of the animal experiments appear to be closely reduplicated in instances of human cancer following prolonged exposure to x-rays, radium emanations, trauma, tar, and certain other commercial materials. This knowledge is now commonly employed in the prophylaxis of external cancer through the prevention of exposure.

The findings in the genetic studies of spontaneous cancer in animals have not as yet received sufficient confirmation from clinical studies to establish their application to the problem of cancer in man. The conditions of the animal experiments appear on the surface to differ decidedly from those related to the occurrence of human cancer, among other ways in the matter of consanguinous breeding. However, sight must not be lost of the possibility that in the human, selection may occur without inbreeding. Indeed the evidence available from clinical observation so far, supports the view that susceptibility to cancer in man is transmissible by heredity. Hauser and Weller[2] have recently brought up to date the family first reported by Warthin in which 41 of the 305 descendants of "G" had 43 primary cancers located in the gastrointestinal tract or uterus, an incidence of 23.6 per cent among those reaching 25 years of age. McKenney[3] has reported 2 families of 46 members, 37.7 per cent of whom had polyposis of the colon, followed in these by death from cancer in 44 per cent. The study of 201 families by Martynova[4] points to the hereditary transmission of a susceptibility to cancer of the breast. Recently Holman[5] also has cited instances to suggest an hereditary factor in the development of cancer. Especially significant are the observations of McFarland and Meade[6] on tumors in uniovular twins. In all of 20 instances which could be collected,

the tumor was present in the same organ of each twin. In one case both twins developed sarcoma of the right testicle at the same age and in another instance both twins simultaneously developed duct carcinoma of the right breast.

Though scarcely convincing in numbers, these clinical reports give substance to the concept of an hereditary transmission of cancer in man. Certainly there is sufficient evidence to justify periodic health examinations and strict attention to sources of minor irritation in the members of families in which cancer has appeared in succeeding generations. Also, the prospect which this evidence holds for a preventive method of genetic control warrants an intensive investigation of the familial characteristics of human cancer.

Any program for the prophylactic control of cancer by restriction of breeding in predisposed families should be based on sufficient authentic case reports, supported by accurate clinical records, roentgenograms and microscopic tissue sections. It is possible that among the older families of communities where medical facilities have long been adequate, there are already available the additional data needed for reaching a decision in this matter. Considering the seeming inadequacy of present means of control a decision is ill deferred on the trial of any reasonable new method with promise of mitigating the scourge of human cancer.

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THE NEUTRON

The probable, and tentatively accepted, composition of the neutron is an "intimate" union of a single proton (elementary 1 unit positive charge of electricity) and a single electron (elementary 1 unit negative charge of electricity). The neutron therefore has no external electric charge and for this reason it can easily penetrate certain types of material, particularly those not electrically active. Specifically, dense inorganic substances such as metals, bone, etc., are more transparent to neutrons than less dense highly charged organic substances, like the soft tissues of the human body and other materials with a high hydrogen content. In general this is exactly the reverse of the penetrating power of x-rays and the gamma rays of radium.

Neutrons also cause ionization (tissue effect) in an entirely different manner from electro-magnetic vibrations, x-rays and gamma rays. The latter produce ionization by liberating high speed electrons from atoms while neutrons produce their effect by "head-on" collisions with protons of an atomic nucleus. The proton recoils with great force and sets up intense ionization over a comparatively short path until it "picks up" an electron and becomes a protium (a loosely bound proton and electron, the so-called hydrogen atom). The exact procedure of neutron ionization can be studied photographically in the Wilson Cloud Chamber.

E. O. Lawrence says[1], "We have carried out some experiments which indicate that the neutron dosage measurements obtained with the Victoreen meter are approximate indications of the ionization in ordinary biological tissue." Neutrons are produced by bombarding a target of light metal (beryllium) with deutrons (a neutron plus a proton or the heavy hydrogen nucleus). The neutron is split off by the bombardment.

It is perhaps idle to speculate on the possible clinical application of the neutron as its production is now only possible in a select few physics laboratories, but the concluding table from Lawrence[1] gives a summary of some preliminary experimental work on biological materials:

DOSAGES OF NEUTRONS AND X-RAYS TO DESTROY

	Neutrons	X-Rays
Mammary cancer in the mouse	700 R.	3,600 R.
Drosophila eggs (by Zirkle & Abersold)	87 R.	180 R.
Wheat seedlings (by Zirkle & Abersold)	120 R.	600 R.
Fern spores (by Zirkle & Abersold)	21,000 R.	52,000 R.

While the neutrons are 5 to 1 more effective against mouse cancer than x-rays we should not conclude that they will prove clinically more efficacious in the treatment of human cancer. Further, the measurements of the neutron may be inaccurate and if the measurements are correct it will be necessary to prove that they exert selective action, as do x-rays, otherwise their application will be very limited. Finally, it is almost impossible to prophesy whether it will ever be possible to produce neutrons with the ease, safety and economy of x-rays.

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ADJUNCTS TO IRRADIATION

In the age-long search for agents to alleviate or cure cancer a multitude of substances have been tried. Ever since the radiologist has shared the treatment of neoplastic disease with the surgeon attention has been directed toward discovering means of augmenting the desired effects of irradiation. Efforts to improve the effectiveness of tumor irradiation have followed two main trends, namely, improved means and methods of administering the irradiation and alteration of the developmental conditions of the tumor in order to increase its radiosensitivity. Physical and chemical adjuncts to irradiation have been the subject of much research and a variety of elements and compounds have been tested on animal tumors, thus building up a fund of information procurable by no other means. A rational therapeusis along this line of approach is fundamentally dependent on the ever increasing knowledge of the differences between the metabolism of normal and malignant tissue. The development of satisfactory adjunctive technics and procedures is an important desideratum, particularly for treating radioresistant tumors having a sensitivity approaching that of neighboring normal tissue.

The literature of the past year or two contains many references to radiotherapeutic adjuncts. No attempt is here made at reviewing all the pertinent reports but some of the procedures which have been applied in the treatment of patients are mentioned.

Auler[1] in enumerating methods to supplement roentgenotherapy mentions chemotherapy, vaccines and sera, hormones and catalyzers, and diet. Warren[2], Jares and Warren[3], Meyer and Mutscheller[4], have reported that elevation of tissue temperature by the applica-

tion of short waves is a promising adjunct for increasing the responsiveness of human neoplasms to irradiation. These experiments on radio-sensitization support the earlier observations on animal tumors made, among others, by Rohdenburg and Prime[5], Overgaard[6], and Harker and Moppett[7]. Preliminary evidence on a limited number of patients seems to indicate that fractional x-irradiation combined with repeated elevation of tissue temperature is more effective than either alone; that in the treatment of deep-seated lesions the short wave field is best applied at right angles to the x-ray beam; and that the temperature elevation should immediately precede and preferably continue through the time of x-ray exposure. The promise foreshadowed by tentative results needs no emphasis but experience is necessary and caution must be exercised to avoid disaster.

The use of heavy metals as measures supplementary to irradiation is reported by Grode[8], Maisin et al[9,10], and Nemec[11]. Grode states that beneficial results were obtained in the treatment of "incurable" carcinomas by combining injections of chromic acid, with and without arsenous acid, and radium irradiation. The hypothetical explanation he offers is that oxidation of the cancer cells was increased and an acid reaction was produced in the tissue! In the treatment of cancers of the oral cavity and the inferior division of the pharynx Maisin and co-workers have clinically observed, at the end of a three-year period, that better results were obtained by combined barium therapy (minute doses of barium saccharate orally) and irradiation than from radiotherapy alone. Calcium gluconate was administered in conjunction with the barium. A higher percentage of cures is likewise reported for cases of breast cancer treated by roentgen and gamma rays when the barium is given during the radiation treatment. Nemec recommends larger doses of barium in the form of intravenous injections of barium nitrate as an efficient adjuvant to x-irradiation and surgery, especially for pulmonary carcinoma.

Kottmann[12] cites a case of hilar lymphogranuloma and one of carcinoma solidum (involving the mediastinum) in which oral and intravenous administration of an organic iodine compound, iod-naphthol-disulfo-acetate, was used to increase the radiosensitivity of the malignant cells. The complete regression of the tumors under the combined treatment as reported is not conclusive proof but does suggest a possible merit in the procedure.

In fact, all the measures proposed as adjuvants of radiotherapy require further adequately controlled investigation and additional clinical experience with a large number of cases before they can be properly evaluated.

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GENERAL NEWS ABOUT CANCER

PARTIAL SUMMARY OF REPORT OF ACTIVITY OF THE AMERICAN SOCIETY FOR THE CONTROL OF CANCER FOR THE YEARS 1935-36, 1936-37.

"The situation has now reached a point where, in states where full cooperation is still not obtained, the intelligent citizens are exerting entirely legitimate pressure upon the profession. The demand that the profession participate actively in the work of cancer education and that it cooperate with the Society is fully justified on several grounds.

First, we know enough about the nature and distribution of cancer to be able to assert that tens of thousands of lives could be saved annually by the intelligent and prompt application of the knowledge which we now possess. This introduces the factor of obligation to act in the interest of humanity.

Second, the Board of Directors of the Society consists of thirty members of whom over eighty per cent are members of the medical profession. These men represent the outstanding figures in the fields of cancer research, therapy and education. This guarantees an intelligent and sympathetic point of view towards the interest and needs of the profession. The board is continually on the alert to stimulate and reward professional ability and interest wherever these are manifest.

Third, the profession needs all the friendly agents available to interpret it to the general public. In times of rapid social change, thinking is apt to be foggy and sense of values is likely to become warped and distorted. The medical profession is feeling this attitude at the present time. The understanding and support of such organizations as the American Society for the Control of Cancer can serve as an unbiased and powerful factor in developing and maintaining mutual understanding and regard between lay and medical groups."

From the Bulletin, October, 1937.

OPENINGS OF NEW CANCER CLINICS

A new clinic for treatment of cancer was dedicated at the Elizabeth General Hospital in New Jersey in memory of Dr. James S. Green. The Clinic was made possible by a fund of $25,000 raised by the hospital board, members of the staff, the woman's auxiliary and contributions of friends.

A cancer clinic has been organized at the Berkeley General Hospital in California, for patients not entirely depending on charity but who are unable to pay the full fee. Part-pay patients will not be given treatment unless they are referred by their family physicians or approved by the social service department after careful investigation of their financial status. All physicians particularly interested in the diagnosis and treatment of cancer are invited to attend.

RUTH JERVEY.